2013 Chesterfield WaterTrends Report of the Quality of Select Streams, Rivers and Lakes in Chesterfield County, Virginia

Swift Creek looking upstream in Pocahontas State Park

Chesterfield County
Department of Environmental Engineering
Water Quality Section

March 2014

Executive Summary

In 2013, volunteer monitors conducted water quality investigations at twenty-nine stream and river stations and two lake stations in Chesterfield County. There were 331 individual surveys conducted by 34 volunteer monitors, representing a total of 468.35 hours of effort. Three new monitors joined the program in 2013. A basic suite of parameters was measured at each site including pH, dissolved oxygen, water temperature and clarity. Water depth was recorded at fifteen stream and river reaches and at one lake site. Ambient air temperature was noted at all sites. *E. coli* concentrations were measured at nine sites during 2013. Observations of general water conditions, coloration, odors, debris present, plants and wildlife were also recorded.

As in past years, most annual medians of pH, dissolved oxygen and surface water temperature did not violate Virginia Department of Environmental Quality (VA DEQ) surface water standards. Observations of pH indicated that most measurements made during 2013 fell within the acceptable 6.0 to 9.0 units range specified by the VA DEQ. There were 13 observations of low pH that fell below the VADEQ acceptable range. The majority of these measurements were noted within two stream systems Nuttree Branch and Second Branch. Both of these streams are currently on VADEQ's impaired waters list for pH impairments from natural sources. None of the low pH readings observed appeared to be pollution related and overall pH annual median values among all sites were acceptable and similar to those observed during previous years. Exceptions to these observations included two monitoring medians where pH was below 6.0 units.

Dissolved oxygen concentrations indicated adequate to well-oxygenated waters at most sites during 2013. During the year, there were measurements at three stations that did not meet the minimum 4.0 mg/L VADEQ standard for adequate oxygen. The majority of these low readings were limited to one observation during the year. The majority of these low readings were limited to one observation during the year except for Station 15 on Winterpock Creek, which had persistent low dissolved oxygen concentrations. Winterpock Creek listed by the state as a naturally impaired waterway for dissolved oxygen. In general, the majority of the low dissolved oxygen concentrations noted among the sites monitored typically during the warmer summer months.

Monthly median temperatures and individual measurements varied normally according to season. There were no surveys recorded in 2013 that reported water temperature that exceeded the state standard of 32.0°C.

Water clarity was measured with a 120-centimeter turbidity tube (stream and river stations) or by a standard eight-inch Secchi disk at the James River at Enon Park and the Walton Lake stations. The greatest annual median transparencies of ≥120.0 centimeters were observed at ten sites (31%) during 2013. For the second consecutive year, reduced clarity was observed at Nuttree Branch (Station 5) where the annual median transparency was calculated as 36.0 centimeters, the lowest annual median transparency noted among all sites during 2013.

In 2013, *E. coli* monitoring using the Coliscan Easygel method was conducted at nine sites to characterize ambient bacteria levels. The monitoring period medians observed at these stations ranged from <20 CFU/100ml at multiple reaches to 160 CFU/100ml at Station 6, Spring Run at Bird Song Road. There were eight individual measurements made at three sites in 2013 that exceeded the 235 CFU/100ml state bacterial standard for recreational contact. Of these three sites, only the James River at Enon Park location was listed on VA DEQ's impaired waters list for bacterial impairment. Station 6, Spring Run at Bird Song Road, reported three violations of the state standard. These observations were made in July and August after periods of rainfall and when water temperatures were elevated.

Most surveys were conducted on sunny/clear days and partly cloudy/overcast days during normal baseflow or calm conditions. As noted in past reports, the majority of the observations recorded in 2013 indicated a light to dark brown color present in the monitored waters. Odors were infrequently recorded and when noted they were usually described as earthy. Leaves and debris were noted frequently in the fall. A variety of wildlife was observed during the year to include numerous aquatic insects, fish, frogs, turtles, songbirds and waterfowl.

Introduction

This report presents the water quality data collected by volunteer monitors in the Chesterfield WaterTrends Program. The Chesterfield WaterTrends Program began in 2008 when these two separate programs were combined into one program jointly coordinated by the Department of Environmental Engineering - Water Quality Section and Friends of Chesterfield's Riverfront. In 2011, the Water Quality section became the sole administrator in the implementation of WaterTrends and currently holds the Virginia Department of Environmental Quality (VADEQ) grant that funds the program. Chesterfield WaterTrends sites include streams, rivers and lakes. Monitors collected data on a volunteer basis to sample and measure the general state of water quality. The WaterTrends program was included as a monitoring and outreach component of Chesterfield County's VPDES Permit VA0088609 administered by the Department of Environmental Engineering - Water Quality Section.

Residents with an interest in the health of their local water body were involved in the selecting of the sites they monitored. Reaches were selected based upon the presence of public access and the potential for use by the general public for recreational activities. In 2013, Chesterfield WaterTrends began a recertification process where volunteers were observed in the field as they conducted their regular tests. Previously, volunteers were recertified at scheduled group events but those training sessions had become increasingly difficult to schedule as the number of volunteers increased. New volunteers were trained as they apply to the program. This change in training was more efficient for both the trainer and the monitor and it allowed for individual attention during the training process. Monitors were asked to commit to the program for a period of at least one year. After a monitor's first year in the program, he/she was required to attend an annual recertification session each subsequent year to assure quality of technique and to update operating procedures as needed. In 2013, thirty stream and river sites and two lake sites were monitored. Nine of the sites were monitored for *E. coli* bacteria. Three new volunteers were trained in 2013.

Methods

A Station ID was assigned to each Chesterfield WaterTrends site. All stream and river sites were assigned a single or double-digit number. All lake sites were given a triple digit number, where the first two digits represent the lake and the last digit denotes the site on the lake. As in past years, the sampling frequency for sites in the Chesterfield WaterTrends Program varied. Lake sites were sampled on a monthly basis at multiple stations during the growing season (approximately April – November) from docks or boats. Streams and rivers were monitored year round at varying frequencies. A suite of parameters was measured at each site: pH, dissolved oxygen, water temperature and turbidity. Water depth was recorded at lake sites and at several stream and river sites. Ambient air temperature was also noted. Observations of general water conditions, water color, odors, debris, plants and wildlife were recorded as part of the site visit.

Chesterfield WaterTrends volunteers used an armored Celsius thermometer to record water and air temperature. Dissolved oxygen was measured using a modified Winkler titration field kit (LaMotte#5860) and pH was measured using a precision pH field kit (LaMotte#5858). Turbidity was measured at lakes and most river sites using a standard eight-inch diameter Secchi disk. At the majority of stream sites, a 120-centimeter turbidity tube was used to measure water clarity (turbidity). Trophic State Index values were calculated for lakes. Water depth was determined using the Secchi disk as a sounding line. When possible, duplicate measurements were made to verify readings. At nine sites, *E. coli* levels were determined using the Coliscan Easy-Gel Kit, a method using pre-packaged sterile agar media and a five-milliliter water sample to grow bacteria on a pre-treated sterile Petri dish. Observed *E. coli* densities were expressed as Colony Forming Units per 100 milliliters (CFU/100ml).

Datasheets were completed in the field and entered into a Microsoft Excel spreadsheet by each monitor. The spreadsheets and datasheets were submitted quarterly to the Water Quality section staff. The spreadsheets were compiled and reviewed for quality control. All data was uploaded into the VADEQ's Virginia Volunteer/Non-Agency Monitoring Database.

Station Descriptions and Data Summaries

The following pages describe each site and a summary of the data and observations made during 2013. Annual median values for each monitored parameter have been calculated and outlined in each site summary table when applicable. Associated maps depict the sampling station locations. Field sheets for each site and monitoring survey are included in Appendix A.

Station ID: 1

Site: James River at Robious Landing Park

Latitude: 37.5591

Longitude: 77.6469

Watershed: James River

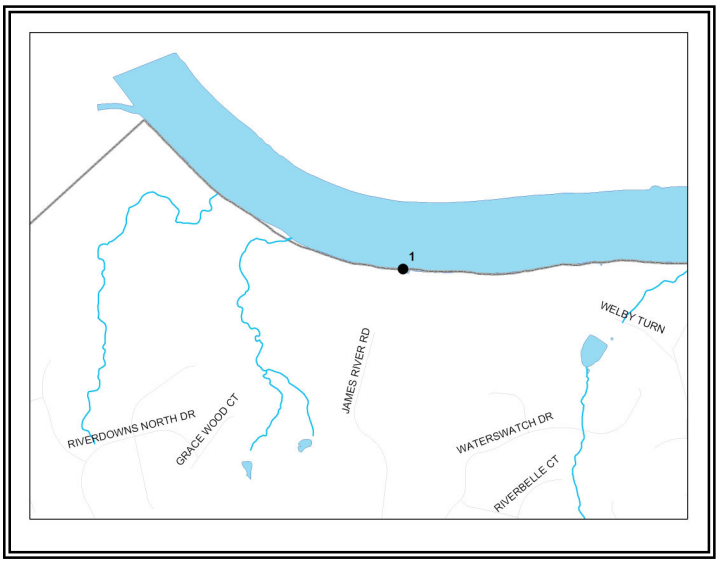
Land use: Mixed

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 18.0

Monitoring since: August 2001



This site is located on the James River in the northern portion of Chesterfield County within the Robious Landing Park. River measurements and water samples were obtained from the wooden boat dock at the park once per month. A total of twelve surveys were conducted during 2013.

Table 1-1. Monthly values and annual medians for each water quality parameter measured during 2013.

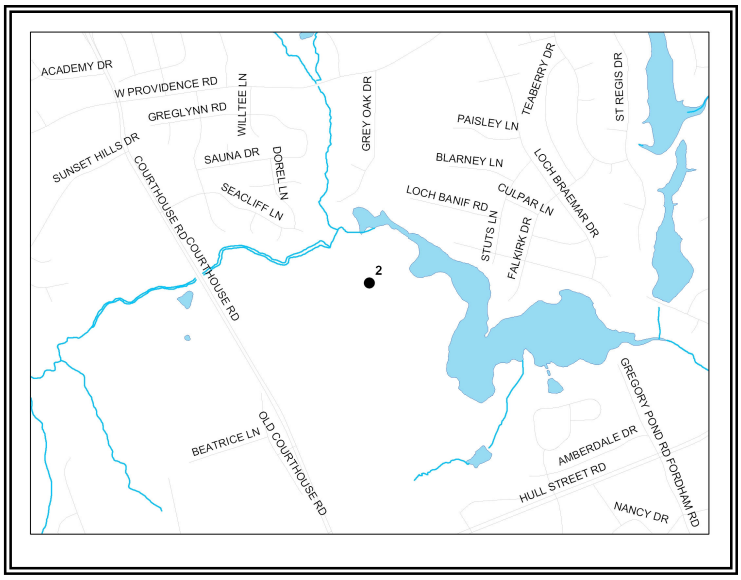
Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	8.0	5.0	10.7	7.0	≥120.0	*	*
February	1	13.0	5.5	10.0	7.5	36.0	*	*
March	1	7.5	6.0	9.7	7.5	94.0	*	*
April	1	18.0	12.0	8.9	7.5	67.5	*	*
May	1	22.0	16.0	7.3	7.0	60.0	*	*
June	1	23.0	26.0	5.7	7.0	≥120.0	*	*
July	1	25.0	26.0	6.0	7.0	48.0	*	*
August	1	26.0	27.0	7.4	8.0	≥120.0	*	*
September	1	25.0	26.0	6.2	7.0	≥120.0	*	*
October	1	25.0	22.0	7.2	7.5	≥120.0	*	*
November	1	9.5	8.0	9.0	7.5	≥120.0	*	*
December	1	6.5	4.0	11.5	7.0	49.0	*	*
	Minimum	6.5	4.0	5.7	7.0	36.0	*	*
	Median	20.0	14.0	8.2	7.3	107.0	*	*
	Maximum	26.0	27.0	11.5	8.0	≥120.0	*	*
	2012 Annual Median	*18.0*	*15.8*	*8.8*	*7.5*	*≥130.0*	*	*
	2011 Annual Median	*20.5*	*17.5*	*9.2*	*7.5*	*≥120.0*	*	*
	2010 Annual Median	*17.0*	*16.5*	*8.6*	*7.5*	*≥120.0*	*	*
	2009 Annual Median	*22.0*	*15.5*	*7.8*	*7.5*	*92.0*	*	*
	2008 Annual Median	*16.0*	*15.5*	*8.2*	*7.5*	*≥120.0*	*	*

Sampling of the James River at Robious Landing Park was conducted from January through December during 2013. Seven surveys occurred on clear/sunny days and five surveys occurred on overcast or partly cloudy days. Normal baseflow conditions were noted on four dates, high/elevated flows on three dates and low flows on five dates. Water color was recorded as clear on six of the surveys with turbid conditions recorded on five events. There was one event when the river was noted as foamy (September).

Leaves and debris were the most often recorded floatable observed in the water and were noted on two occasions during 2013. No perceptible odors were noted during 2013.

As in past years, water depth was not measured at this site. Monthly transparency values, as measured by turbidity tube, ranged from a low of 36.0 centimeters in February to ≥120.0 centimeters on multiple occasions. The annual median transparency value of 107.0 centimeters was consistent with years past. As noted during previous years' monitoring, all monthly pH values during 2013 were within the 6.0 - 9.0 units standard range set by the state. Additionally, no individual pH measurements violated the state standard during 2013. Monthly surface temperatures ranged from 4.0 to 27.0^{o}C and varied normally with season. No individual temperature values exceeded the state standard of 32.0^{o}C during 2013. All individual dissolved oxygen concentrations were above the state standard of 4.0 mg/L and were indicative of well-oxygenated waters. All observations in 2013 were indicative of continued excellent water quality at this site.

Station ID: 2



Site: Unnamed Tributary to Falling Creek in Rockwood Park

Latitude: 37.4542

Longitude: 77.5804

Watershed: Falling Creek

Land use: Residential, County Park

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 33.5

Monitoring since: August 2001

This site is located on an unnamed tributary to Falling Creek in the north central portion of Chesterfield County within the county's Rockwood Park. Stream measurements and water samples were obtained from the wooden footbridge one quarter of a mile past the nature center one to two times per month from January to December. A total of thirteen surveys were conducted during 2013.

Table 1-2. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	-1.0	0.0	11.9	6.5	57.0	0.56	*
February	1	1.0	2.0	11.5	6.0	85.0	0.53	*
March	1	12.0	8.5	9.9	7.0	106.0	0.55	*
May	2	17.5	17.3	5.3	6.3	99.0	0.51	*
June	1	18.8	20.0	5.6	6.0	95.0	0.48	*
July	1	21.0	22.0	4.1	6.0	81.0	0.46	*
August	1	24.5	23.5	4.9	6.0	≥120.0	0.48	*
September	1	17.0	16.0	6.0	6.0	≥120.0	0.42	*
October	1	17.0	18.0	4.6	6.5	110.0	0.41	*
November	1	8.0	6.5	8.8	6.5	95.0	0.46	*
December	2	3.5	3.7	10.3	6.5	53.4	0.56	*
Minimum		-1.0	0.0	4.1	6.0	53.4	0.41	*
Median		17.0	16.0	6.0	6.3	95.0	0.48	*
Maximum		24.5	23.5	11.9	7.0	≥120.0	0.56	*
2012 Annual Median		*19.5*	*16.3*	*6.9*	*6.5*	*72.0*	*0.52*	*
2011 Annual Median		*11.0*	*7.5*	*9.3*	*6.5*	*66.0*	*0.65*	*
2010 Annual Median		*21.0*	*19.0*	*6.0*	*6.5*	*86.8*	*	*
2009 Annual Median		*17.5*	*12.0*	*8.1*	*6.5*	*118.0*	*	*
2008 Annual Median		*22.0*	*16.5*	*7.2*	*6.5*	*90.6*	*	*

Sampling of this unnamed tributary to Falling Creek was conducted during twelve months in 2013. Twelve of the monitoring events occurred during clear/sunny days with overcast conditions noted for one day. High flow conditions were observed for the first six months of the year. Normal base-flow conditions were recorded on five of the surveys and low flow conditions were noted in October and November. Water coloration

was light brown during most of the year and turbid in December. Leaves and debris were seen during all sampling events. As in previous years, there were no perceptible odors recorded for 2013.

Water depth was measured at this site on several occasions with monthly values recorded as 0.41 to 0.56 meters. Monthly transparency values ranged from a low of 53.4 centimeters in December to ≥120.0 centimeters during August and September. The annual median value of 95.0 centimeters was notably greater than the 2012 annual median of 72.0 centimeters and was in the range of previously observed values. All monthly pH values during the year were within the 6.0 - 9.0 units state standard. Additionally, no individual pH measurements violated the state standard during 2013. Values for pH ranged from 6.0 to 7.0 indicating a well-buffered stream. Monthly surface temperatures ranged from -1.0 to 24.5^{o}C and varied normally with season. No individual values exceeded the state standard of 32.0^{o}C during 2013. All monthly median dissolved oxygen concentrations noted during 2013 were at or above the state standard of 4.0 mg/L and were indicative of well-oxygenated waters. The annual median dissolved oxygen concentration (6.3 mg/L) was above the 4.0 mg/L threshold indicating well-oxygenated waters. Water quality measurements at this site continue to suggest very good water quality.

Station ID: 3

Site: Unnamed Tributary to Falling Creek at Midlothian Mines Park

Latitude: 37.4917

Longitude: 77.6429

Watershed: Falling Creek

Land use: Residential, Commercial, Park

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 10.0

Monitoring since: June 2008

This site is located on an unnamed tributary to Falling Creek in the north central portion of Chesterfield County within the county's Midlothian Mines Park. Stream measurements and water samples were obtained from the stream located approximately 50 meters west of Groveton Terrace, once per month from February to December. A total of five surveys were conducted during 2013.

Table 1-3. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	5.0	4.0	10.0	6.0	85.0	*	*<20*
February	1	9.0	6.0	10.1	6.5	75.0	*	*<20*
March	1	8.5	6.0	10.3	6.5	95.0	*	*<20*
April	1	15.0	18.0	7.0	6.5	60.0	*	*
May	1	26.0	23.0	5.1	6.5	83.0	*	*
	Minimum	5.0	4.0	5.1	6.0	60.0	*	*<20*
	Median	9.0	6.0	10.0	6.5	83.0	*	*<20*
	Maximum	26.0	23.0	10.3	6.5	95.0	*	*<20*
	2012 Annual Median	*19.0*	*20.0*	*5.1*	*6.5*	*70.0*	*	*<20*
	2011 Annual Median	*	*	*	*	*	*	*
	2010 Annual Median	*20.0*	*16.0*	*7.6*	*7.0*	*73.6*	*	*
	2009 Annual Median	*21.0*	*19.0*	*7.5*	*6.0*	*52.8*	*	*
	2008 Annual Median	*21.5*	*20.3*	*7.0*	*6.0*	*42.4*	*	*

Sampling was conducted at the unnamed tributary to Falling Creek site over five months during 2013. Two of the sampling events occurred during clear/sunny or partly cloudy days and two events occurred during rain. Normal baseflow conditions were noted on three surveys with a low flow condition noted on one occasion one high flow condition noted during a storm event. Water coloration was typically recorded as varying shades of light brown. One sampling event (April) noted a milky appearance. Leaves and debris were noted once, in March. There were no perceptible odors observed during 2013.

As in past years, water depth was not measured at this site. Monthly transparency values as measured by turbidity tube ranged from a low of 60.0 centimeters in April to 95.0 centimeters in March. The annual median transparency value (83.0 centimeters) was the within the range of previously observed values. As noted during previous years' monitoring, all monthly pH values during the 2013 were within the 6.0 - 9.0 units standard range set by the state. Additionally, no individual pH measurements violated the state standard during 2013. Monthly surface temperatures ranged from 5.0 to 26.0^{o}C and varied normally with season. No individual temperature values exceeded the state standard of 32.0^{o}C during 2013. The median annual dissolved oxygen level was 10.0 mg/L. *E. coli* measurements were made for the first four months of 2013. Samples were incubated for approximately 48 hours at 25^{o}C with all resulting densities ranging from <20 CFU/100ml. No samples exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact. Water quality measurements at this site suggest fair to good water quality.

Station ID: 4

Site: Swift Creek near Bailey Bridge Middle School

Latitude: 37.4098

Longitude: 77.6165

Watershed: Swift Creek

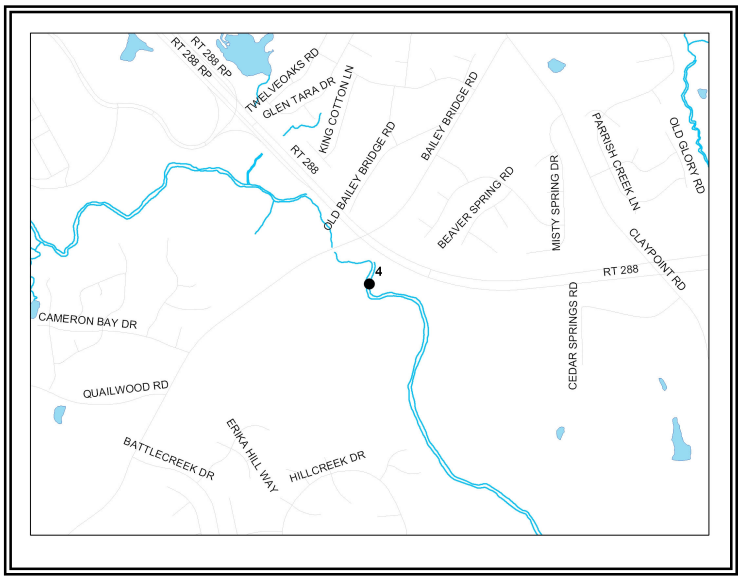
Land use: Residential, Commercial and School

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 26

Monitoring since: August 2001



This site is located on the mainstem of Swift Creek, one of the major waterways of Chesterfield County. The site lies just downstream of the Swift Creek Reservoir in the central portion of Chesterfield County. Stream measurements and water samples were obtained from Swift Creek downhill from the Bailey Bridge Sewage Pump Station one to two times per month with a total of thirteen surveys conducted during 2013.

Table 1-4. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	11.5	5.0	10.3	6.5	≥120.0	0.74	*
February	1	8.5	6.0	11.5	6.5	80.0	0.75	*
March	1	5.5	6.5	11.1	6.5	85.0	0.82	*
April	1	14.0	19.0	8.2	6.5	116.0	1.15	*
May	1	28.5	27.0	6.7	6.5	≥120.0	0.97	*
July	2	27.0	27.5	5.3	6.5	90.5	1.45	*
August	1	27.0	26.5	5.3	7.0	≥120.0	0.57	*
September	2	27.3	23.5	5.5	6.8	≥120.0	0.62	*
October	1	12.5	9.5	6.7	6.5	≥120.0	0.90	*
November	1	15.5	9.5	7.6	6.5	≥120.0	0.99	*
December	1	19.0	10.5	10.1	6.5	62.0	1.09	*
	Minimum	5.5	5.0	5.3	6.5	62.0	0.57	*
	Median	15.5	10.5	7.6	6.5	≥120.0	0.90	*
	Maximum	28.5	27.5	11.5	7.0	≥120.0	1.45	*
	2012 Annual Median	*21.8*	*18.0*	*6.7*	*6.8*	*≥130.0*	*0.67*	*
	2011 Annual Median	*16.0*	*13.8*	*7.3*	*6.8*	*≥130.0*	*0.61*	*
	2010 Annual Median	*19.0*	*19.0*	*6.2*	*6.5*	*≥130.0*	*0.61*	*
	2009 Annual Median	*27.0*	*21.0*	*6.0*	*6.5*	*≥130.0*	*	*
	2008 Annual Median	*23.0*	*19.0*	*7.0*	*7.0*	*94.0*	*0.56*	*

Sampling of this Swift Creek site was conducted multiple times over 12 months during 2013. The majority (n=11) of the sampling events occurred during partly cloudy or overcast days. One survey occurred on a clear day. One survey occurred during a storm event. High flow conditions were noted on seven surveys. Normal flows were noted during four events. Two surveys recorded low flow conditions. Water coloration ranged from clear with green/brown tinges to turbid, usually in conjunction with the high flow

observations. There were no perceptible odors present during 2013. Construction activities on the bridge over Swift Creek that began in June of 2011 continued throughout 2013.

Water depth at this site ranged from 0.57 meters to 1.45 meters with an annual median value of 0.90 meters. Monthly transparency values ranged from a low of 62.0 centimeters in December to ≥120.0 centimeters on multiple occasions (n=6) during the year. The annual median value of ≥120.0 centimeters was among the greatest observed at all sites in 2013 and was identical to the past three years' values. The transparency at this site was indicative of very clear waters. As noted for the previous three years, all monthly pH values during 2013 were within the 6.0 - 9.0 units state standard range. Monthly surface temperatures ranged from 5.0 to 27.5^{o}C and varied normally with season. No individual values exceeded the state standard of 32.0^{o}C during 2013. All median dissolved oxygen concentrations were at or above the minimum state standard of 4.0 mg/L. Observations were suggestive of excellent water quality at this site.

Station ID: 5

Site: Nuttree Branch in Brandermill

Latitude: 37.4517

Longitude: 77.6605

Watershed: Swift Creek

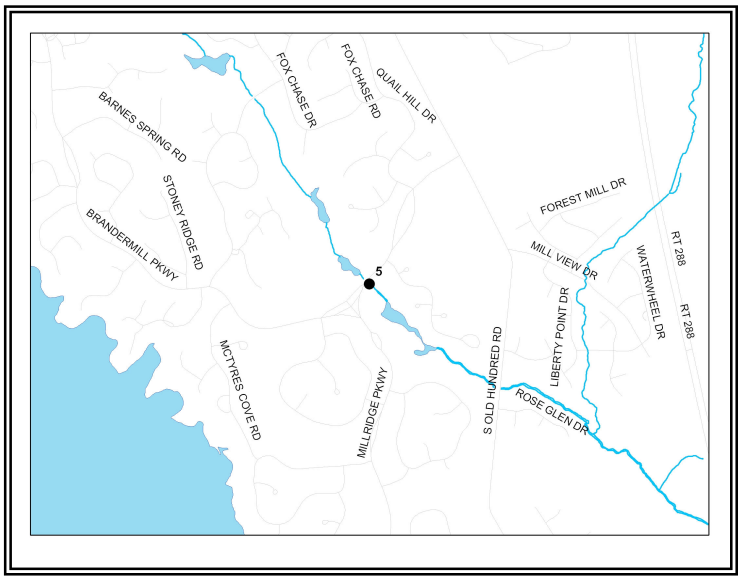
Land use: Residential, School

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 7.0

Monitoring since: April 2008



This site is located on Nuttree Branch in the west central area of Chesterfield County at Swift Creek Elementary School on Genito Road. Stream measurements and water samples were obtained two to three times per month from January to March near a small footbridge on a bike path accessed from the parking lot. A total of seven surveys were conducted during 2013.

Table 1-5. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml)
January	2	10.5	8.0	9.0	5.8	28.5	0.12	*
February	2	12.5	7.5	9.9	5.8	36.0	0.12	*
March	3	14.0	7.0	11.3	5.5	51.0	0.10	*
	Minimum	10.5	7.0	9.0	5.5	28.5	0.10	*
	Median	12.5	7.5	9.9	5.8	36.0	0.12	*
	Maximum	14.0	8.0	11.3	5.8	51.0	0.12	*
	2012 Annual Median	*24.0*	*18.0*	*2.5*	*5.5*	*13.0*	*0.07*	*
	2011 Annual Median	*18.0*	*18.5*	*6.3*	*6.5*	*36.4*	*	*
	2010 Annual Median	*22.3*	*22.0*	*7.7*	*6.5*	*55.8*	*	*
	2009 Annual Median	*20.5*	*20.2*	*8.4*	*6.5*	*51.0*	*	*
	2008 Annual Median	*24.0*	*22.5*	*7.0*	*6.5*	*56.0*	*	*

Sampling of Nuttree Branch was conducted from January to March in 2013. Three survey events occurred during clear/sunny days and four were conducted on overcast or partly cloudy days. Normal baseflow conditions were observed on three of the surveys. High flow observations were made on four occasions. As in previous years, water color was recorded as varying shades of brown with clear conditions noted five times. Algae were noted in January. Leaves and debris were noted in late March. No odors were noted during 2013.

Water depth in 2013 ranged from 0.10 meters to 0.12 meters with an annual median value of 0.12 meters. Monthly transparency values ranged from a low of 28.5 centimeters in January to 51.0 centimeters in March. The annual median value (36.0 centimeters) was

an increase over the 2012 median. The observed annual median pH was 5.8 units, which is less than the state standard pH range of the 6.0 - 9.0 units and was consistent with the 2012 median. Monthly surface temperatures ranged from 7.0 to 8.0^{o}C and varied normally with season. No individual values exceeded the state standard of 32.0^{o}C during 2013. All individual measurements of dissolved oxygen were higher than state minimum standard of 4.0 mg/L. The 2013 median dissolved oxygen concentration was 9.9 mg/L. Water quality measurements at this site suggest fair to good water quality.

Station ID: 6

Site: Spring Run behind Birdsong Lane

Latitude: 37.4073

Longitude: 77.6441

Watershed: Swift Creek

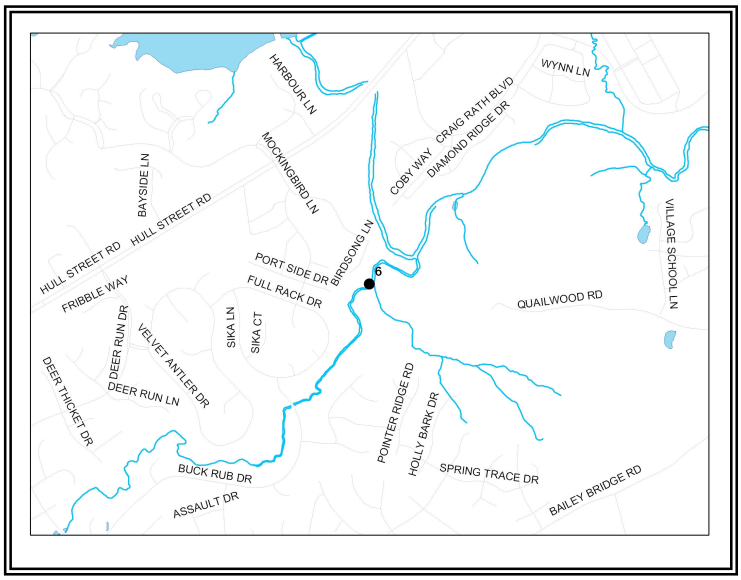
Land use: Residential

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 10.75

Monitoring since: April 2008



This site is located on Spring Run in the west central area of Chesterfield County at a private residence on Birdsong Lane within the Mockingbird Hills subdivision. Stream measurements and water samples were obtained one to two times per month from January through December. A total of twenty-three surveys were conducted during 2013.

Table 1-6. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	2	3.8	3.5	12.4	6.8	99.5	*	80
February	2	5.8	5.5	11.9	7.0	72.0	*	*
March	3	9.0	7.3	11.5	7.0	54.0	*	20
April	2	23.3	15.0	10.0	7.0	≥120.0	*	80
May	1	21.0	18.0	7.7	7.0	≥120.0	*	*
June	2	29.0	21.5	6.6	7.0	≥120.0	*	*
July	1	24.0	24.0	6.8	7.0	62.0	*	1020
August	2	22.5	19.8	7.7	6.8	88.5	*	1180
September	3	19.5	14.5	8.4	7.0	≥120.0	*	220
October	1	14.5	12.0	8.2	7.0	≥120.0	*	*
November	2	19.5	11.5	7.8	7.0	≥120.0	*	100
December	2	13.3	9.5	10.2	6.8	74.5	*	*
	Minimum	3.8	3.5	6.6	6.8	54.0	*	20
	Median	19.5	13.3	8.3	7.0	109.8	*	100
	Maximum	29.0	24.0	12.4	7.0	≥120.0	*	1180
	2012 Annual Median	*21.0*	*18.0*	*7.8*	*7.0*	*≥130.0*	*	*180*
	2011 Annual Median	*23.0*	*17.5*	*8.3*	*7.0*	*≥130.0*	*	*
	2010 Annual Median	*18.8*	*15.8*	*8.4*	*7.0*	*≥130.0*	*	*
	2009 Annual Median	*26.3*	*20.5*	*7.6*	*7.0*	*≥130.0*	*	*
	2008 Annual Median	*23.0*	*18.5*	*7.2*	*7.0*	*≥130.0*	*	*

Sampling of Spring Run was conducted from January through December of 2013 with multiple visits most months. Clear/sunny conditions were recorded on thirteen of the sampling events. Overcast or partly cloudy conditions were observed on six surveys. Showers were recorded on three of the surveys. Normal baseflow conditions were noted on most surveys (13) with six low flow events and three high flow events. Clear water was observed on twelve surveys and turbid conditions were noted on ten surveys. As in

past years, no perceptible odors were recorded during 2013. Leaves and debris were noted three times.

As in previous years, water depth was not measured at this site. Monthly transparency values ranged from a low of 54.0 centimeters in March to ≥120.0 centimeters on the majority of the remaining months. As noted in prior reports, the annual median value of 109.8 centimeters was characteristic of a continued high degree of water clarity. Most monthly pH values ranged from 6.8 to 7.0 units and were well within the 6.0 - 9.0 units standard range set by the state standard. Measurements of pH did not vary substantially month to month during 2013 and the annual median was consistent with years past. Monthly surface temperatures ranged from 3.8ºC in January to 24.0^{o}C in July and varied normally with season. No individual temperature values exceeded the state standard of 32.0^{o}C during 2013. All individual dissolved oxygen concentrations were above the state standard minimum of 4.0 mg/L and were indicative of well-oxygenated waters. The annual median measured 8.3 mg/L during 2013.

E. coli measurements were made eight times in 2013. Samples were incubated for approximately 24 hours at 35^{o}C with resulting densities ranging from 20 – 1180 CFU/100ml. Three measurements made in July and August exceeded the 235 CFU/100ml state bacterial standard for recreational contact. These surveys were made during or shortly after rain events. Water quality measurements at this site suggest fair to good water quality.

Station ID: 8

Site: James River near Enon Park

Latitude: 37.3631

Longitude: 77.3091

Watershed: James River

Land use: Mixed

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 45.5

Monitoring since: August 2001

This site is located on the James River in the eastern portion of Chesterfield County within the Mount Blanco subdivision. River measurements and water samples were obtained from a private dock located on Mount Blanco Road one to two times per month. A total of eighteen surveys were conducted during 2013.

Table 1-7. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Depth (m)	Secchi Depth (m)	*E. Coli* (CFU/100ml
January	1	16.0	9.0	10.2	7.5	1.60	0.70	340
February	1	2.0	7.0	11.1	7.5	1.10	0.60	320
March	2	9.0	7.3	11.3	7.0	2.25	0.55	490
April	1	33.0	20.5	9.1	7.5	1.60	0.60	*
May	2	20.5	20.0	8.4	7.5	1.95	0.55	80
June	2	29.0	28.5	6.6	7.5	1.40	0.55	160
July	1	32.0	29.5	8.3	8.0	1.60	0.50	20
August	2	27.8	27.8	7.7	7.8	1.95	0.55	80
September	2	22.8	24.0	8.2	7.8	1.95	0.60	*
October	1	12.0	17.5	8.2	7.5	1.70	0.40	160
November	2	14.3	11.3	9.8	7.0	1.95	0.40	80
December	1	10.0	10.0	10.5	7.0	1.80	0.50	160
	Minimum	2.0	7.0	6.6	7.0	1.10	0.40	20
	Median	18.3	18.8	8.8	7.5	1.75	0.55	160
	Maximum	33.0	29.5	11.3	8.0	2.25	0.70	490
	2012 Annual Median	*19.0*	*18.5*	*9.1*	*7.5*	*1.70*	*0.60*	*140*
	2011 Annual Median	*22.8*	*21.8*	*9.1*	*7.5*	*1.80*	*0.50*	*
	2010 Annual Median	*20.0*	*19.3*	*9.0*	*7.5*	*1.90*	*0.60*	*
	2009 Annual Median	*20.5*	*18.0*	*9.1*	*7.5*	*2.10*	*0.60*	*
	2008 Annual Median	*21.0*	*19.0*	*8.6*	*7.5*	*2.00*	*0.60*	*

Sampling of the James River at the Enon Park site was conducted from January through December of 2013. Most surveys (15) were conducted on partly cloudy or overcast days. Two surveys were made on clear/sunny days. One survey (March) noted showers and snow. Normal baseflow conditions were noted on 16 surveys. Two surveys noted high flows. A light brown coloration was noted in all surveys in 2013. Leaves and debris were noted on four surveys and bubbles and foam were observed in July, September and

November. A single dead fish was reported in August. No perceptible odors were noted during 2013.

Water depth at this station ranged from 1.10 meters in February to 2.25 meters in March. The annual median water depth was 1.75 meters, a slight increase over the 2012 median of 1.70 meters. As in past years, a Secchi disk was used at this site to measure the clarity of the river. Monthly median Secchi disk transparency values ranged from a low of 0.40 meters in October and November to a high of 0.70 meters in January. The annual median Secchi disk transparency value (0.55 meters) was similar to past reports. All pH values during the year were within the 6.0 - 9.0 units range as set by the state standard. The 2013 annual median pH value (7.5 units) was the same as the past five years. Monthly median surface temperatures ranged from 7.0 to 29.5ºC and varied normally with season. All dissolved oxygen concentrations were above the state standard minimum of 4.0 mg/L and were indicative of well-oxygenated waters. The annual median dissolved oxygen concentration (8.8 mg/L) was in the range of previously observed values. Eleven *E. coli* measurements were made at this site from January through December 2013. Samples were incubated for approximately 48 hours at 32-35^{o}C with resulting densities ranging from 20 – 490 CFU/100ml. The samples between January and March 2013 exceeded the 235 CFU/100ml state bacterial standard for recreational contact. All of the observations at this station continued to suggest generally good water quality.

Station ID: 10

Site: Unnamed Tributary to Powhite Creek at Bon Air Elementary School

Latitude: 37.5271

Longitude: 77.5643

Watershed: Powhite Creek

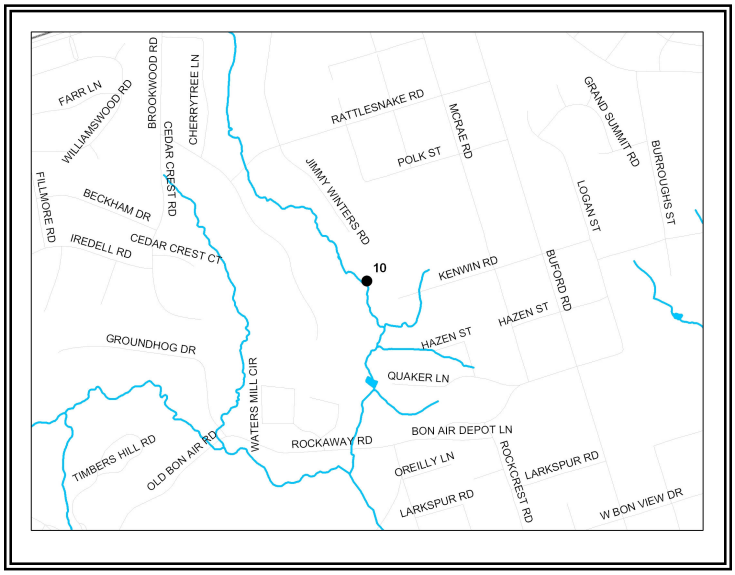
Land use: Residential, School

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 33.0

Monitoring since: July 2010



This site is located on an unnamed tributary to Powhite Creek in the northeastern area of Chesterfield County at Bon Air Elementary School. Stream measurements and water samples were obtained once per month from January to December with a total of twelve surveys conducted during 2013.

Table 1-8. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	20.0	11.0	9.9	6.5	≥120.0	*	160
February	1	9.5	8.0	10.5	6.0	≥120.0	*	20
March	1	11.5	8.5	10.3	6.5	≥120.0	*	<20
April	1	19.5	16.0	8.5	6.5	≥120.0	*	80
May	1	15.0	13.0	9.0	6.0	≥120.0	*	40
June	1	23.5	22.5	6.5	6.5	≥120.0	*	140
July	1	21.5	23.0	6.3	6.5	74.0	*	100
August	1	19.5	18.0	7.1	6.5	≥120.0	*	20
September	1	32.0	23.0	6.4	6.5	≥120.0	*	120
October	1	16.0	14.0	5.0	6.5	≥120.0	*	*
November	1	1.0	4.0	10.0	6.5	≥120.0	*	80
December	1	14.0	8.0	10.6	6.5	≥120.0	*	20
	Minimum	1.0	4.0	5.0	6.0	74.0	*	<20
	Median	17.8	13.5	8.7	6.5	≥120.0	*	80
	Maximum	32.0	23.0	10.6	6.5	≥120.0	*	160
	2012 Annual Median	*18.8*	*15.3*	*7.8*	*6.5*	*≥130.0*	*	*170*
	2011 Annual Median	*17.0*	*14.0*	*7.2*	*6.5*	*≥130.0*	*	*
	2010 Annual Median	*26.7*	*18.5*	*6.6*	*6.0*	*88.1*	*	*

Sampling of this unnamed tributary to Powhite Creek was conducted from January through December of 2013. Seven survey events occurred during overcast or partly cloudy days and five were conducted on clear/sunny days. Normal baseflow conditions were recorded for six of the surveys and low flow conditions were recorded in August September and November. High flows were noted in March, July, and December. Water coloration was recorded as clear on all surveys but July, which was noted as light brown. Heavy rains were noted the day prior to the light brown coloration observation. Leaves and debris were observed during all twelve visits. Algae were noted in the creek during

eight surveys. Unlike 2012, trash was not recorded any time in 2013. An earthy odor was recorded in February, July and November. Fish were present in August.

As in previous years, water depth was not measured at this site during 2013. All but one monthly transparency values were ≥120.0 centimeters indicating a high degree of water clarity. All monthly pH values during the year, as well as the annual median value, were within the 6.0 - 9.0 units state standard range. Monthly surface temperatures ranged from 4.0 to 23.0^{o}C and varied normally with season. No individual temperature measurements exceeded the state standard of 32.0^{o}C during 2013. All monthly dissolved oxygen concentrations (annual median 8.7 mg/L) were above the state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters. Eleven *E. coli* measurements were made at this site from May through December 2013. Samples were incubated for approximately 48 hours at 22^{o}C with resulting densities ranging from <20 – 160 CFU/100ml. No samples exceeded the 235 CFU/100ml state bacterial standard for recreational contact. All observations made during 2013 suggested excellent water quality at this site.

Station ID: 11

Site: Unnamed Tributary to Powhite Creek at Poplar Hollow Trail

Latitude: 37.5142

Longitude: 77.5493

Watershed: Powhite Creek

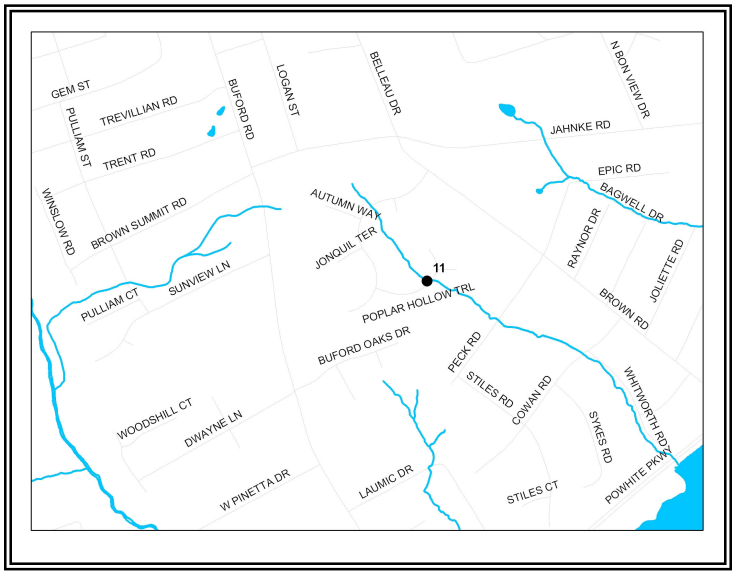
Land use: Residential

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 16.5

Monitoring since: January 2010



This site is located on an unnamed tributary to Powhite Creek in the northeastern area of Chesterfield County. Stream measurements and water samples were obtained approximately once per month from February through December just north of the culvert running under Poplar Hollow Trail in the Spring Grove subdivision. A total of eleven surveys were conducted during 2013.

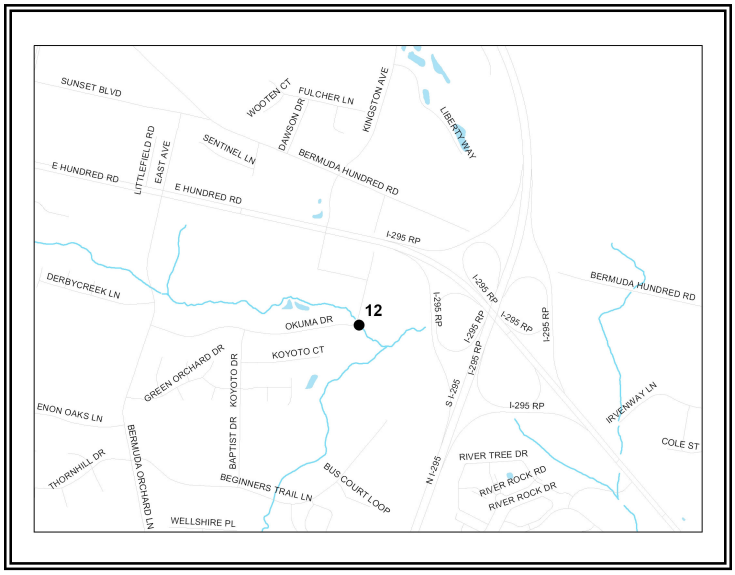
Table 1-9. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
February	2	12.0	8.5	10.6	6.5	≥120.0	0.15	70
April	1	20.0	15.0	9.6	6.0	≥120.0	0.15	<20
May	1	31.5	21.0	7.8	6.5	≥120.0	0.08	60
June	1	31.0	23.0	8.1	6.5	≥120.0	0.14	180
July	1	28.0	20.0	7.9	6.0	≥120.0	0.12	60
August	1	30.0	23.0	8.1	6.0	≥120.0	0.11	40
September	1	21.0	18.0	8.5	6.5	≥120.0	0.14	60
October	1	19.0	15.0	7.9	6.0	≥120.0	0.16	20
November	1	7.5	8.5	9.6	6.0	≥120.0	0.18	60
December	1	13.0	9.0	9.9	6.5	≥120.0	0.13	20
Minimum		7.5	8.5	7.8	6.0	≥120.0	0.08	<20
Median		20.5	16.5	8.3	6.3	≥120.0	0.14	60
Maximum		31.5	23.0	10.6	6.5	≥120.0	0.18	180
2012 Annual Median		*26.0*	*19.3*	*9.4*	*6.0*	*122.5*	*0.10*	*<20*
2011 Annual Median		*17.8*	*14.5*	*9.1*	*6.0*	*≥130.0*	*0.19*	*
2010 Annual Median		*22.0*	*15.5*	*8.7*	*6.0*	*≥130.0*	*0.25*	*

Sampling of this unnamed tributary to Powhite Creek was conducted from February through December of 2013. Clear/sunny conditions were recorded on seven of the surveys. Overcast or partly cloudy conditions were noted on four surveys. Normal baseflow conditions were commonly seen and high flows were observed twice in February. Clear water conditions were observed on eight surveys. Foamy conditions were noted two times, both in February. A light brown coloration was seen in April. Leaves were noted four times in 2013. No perceptible odors were observed during 2013. Observations of erosion were made in May and June.

Water depth at this site ranged from 0.08 to 0.18 meters seen in May and November, respectively. The annual median depth for the sampling area was 0.14 meters, an increase from the 2012 median depth of 0.10 meters. All monthly transparency were ≥120.0 centimeters. All monthly pH values during the year (annual median 6.3 units) were within the 6.0 - 9.0 units state standard range. Monthly median surface temperatures ranged from 7.5 to 23.0^{o}C and varied normally with season. No individual values exceeded the state standard of 32.0^{o}C during 2013. All monthly dissolved oxygen concentrations were above state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters (annual median 8.3 mg/L). Eleven *E. coli* measurements were made at this site during 2013. Samples were incubated for approximately 48 hours at 21^{o}C with densities ranging from <20 to 180 CFU/100ml. None of the samples exceeded the 235 CFU/100ml state bacterial standard for recreational contact. All of the observations at this station were suggestive of continued excellent water quality.

Station ID: 12



Site: Johnson Creek at Kingston Avenue

Latitude: 37.3427

Longitude: 77.3416

Watershed: Appomattox River

Land use: Residential, Commercial

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 20.5

Monitoring since: January 2011

This site is located on the mainstem of Johnson Creek in the eastern area of Chesterfield County near its crossing with Kingston Avenue. Stream measurements and water samples were obtained on a monthly basis from January through September, just east of the culvert on the north bank of the stream. A total of nine surveys were conducted during 2013.

Table 1-10. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml)
January	1	17.0	6.0	9.1	6.0	116.0	0.52	*
February	1	8.0	7.0	6.1	6.0	109.0	0.46	*
March	1	13.0	9.0	9.9	6.0	≥120.0	0.40	*
April	1	28.3	17.2	6.1	6.0	52.8	0.53	*
May	1	27.7	18.8	5.5	6.0	78.0	0.44	*
June	1	30.0	23.0	4.3	5.5	57.0	0.57	*
July	1	34.4	22.2	6.6	6.0	97.0	0.46	*
August	1	33.3	*	7.4	6.0	88.0	0.50	*
September	1	25.0	17.0	8.0	5.5	≥120.0	0.38	*
	Minimum	8.0	6.0	4.3	5.5	52.8	0.38	*
	Median	27.7	17.1	6.6	6.0	97.0	0.46	*
	Maximum	34.4	23.0	9.9	6.0	≥120.0	0.57	*
	2012 Annual Median	*24.0*	*17.3*	*7.4*	*6.0*	*107.0*	*0.46*	*
	2011 Annual Median	*23.0*	*16.0*	*6.1*	*6.0*	*92.0*	*	*

Sampling of Johnson Creek was conducted once per month from January through September of 2013. Four surveys occurred during clear/sunny days and four were conducted on partly cloudy days. One survey was conducted on a rainy day. High flow conditions were seen on eight of the surveys and one normal/baseflow condition was recoded in September. Water coloration was recorded as varying shades of brown or turbid. Earthy odors were scented on six surveys.

Water depth ranged from 0.38 to 0.57 meters. Monthly transparency values ranged from a low of 52.8 centimeters in April to ≥120.0 centimeters in March. The annual median value for transparency was 97.0 centimeters, lower than the previous year's median of 107.0 centimeters. The pH was recorded as 5.5 in June and September, which is below the 6.0 - 9.0 units state standard range. The 2013 annual median pH was 6.0 units. Monthly surface temperatures ranged from 6.0 to 23.0^{o}C and varied normally with season. No individual values exceeded the state standard of 32.0^{o}C during 2013. Monthly dissolved oxygen concentrations ranged from 4.3 mg/L in June to 9.9 mg/L in March with all monthly dissolved oxygen concentrations above state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters. All of the observations at this station continued to suggest generally good water quality.

Station ID: 13

Site: Second Branch at Bundle Road

Latitude: 37.3336

Longitude: 77.6032

Watershed: Swift Creek

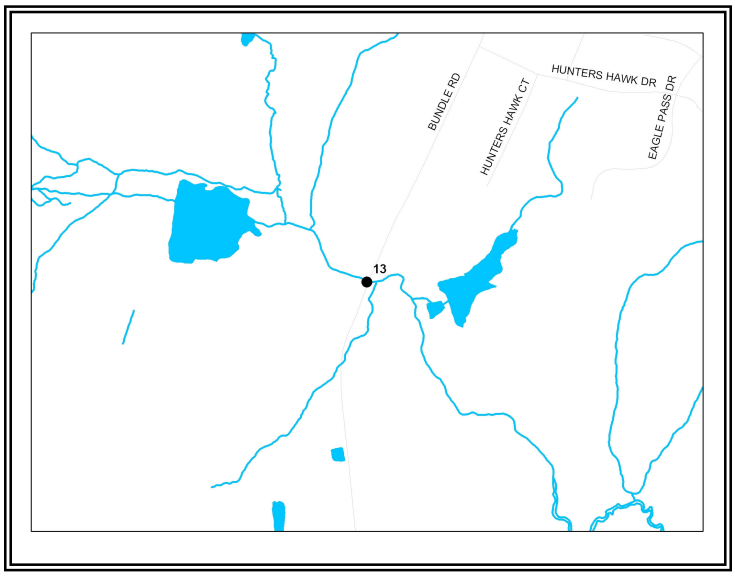
Land use: Rural Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 12.0

Monitoring since: April 2010



This site is located on Second Branch in the south central area of Chesterfield County at its crossing with Bundle Road. Water samples were obtained approximately 3 meter upstream of the bridge along the north bank on a monthly basis from January through June. A total of six surveys were conducted during 2013.

Table 1-11. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	11.0	4.5	8.5	5.5	92.8	*	*
February	1	7.5	4.0	9.4	5.0	72.2	*	*
March	1	13.0	7.0	8.8	5.0	62.0	*	*
April	1	21.5	19.0	5.8	5.5	39.0	*	*
May	1	19.0	19.5	4.6	5.0	39.6	*	*
June	1	26.5	20.5	4.3	5.0	33.4	*	*
	Minimum	7.5	4.0	4.3	5.0	33.4	*	*
	Median	16.0	13.0	7.2	5.0	50.8	*	*
	Maximum	26.5	20.5	9.4	5.5	92.8	*	*
	2012 Annual Median	*21.0*	*14.5*	*8.0*	*7.0*	*120.0*	*	*
	2011 Annual Median	*13.0*	*10.0*	*8.8*	*7.0*	*≥130.0*	*	*
	2010 Annual Median	*16.0*	*17.0*	*7.5*	*7.0*	*≥130.0*	*	*

Five surveys occurred during clear/sunny conditions and one survey was conducted on an overcast day. Normal baseflow conditions were on seen twice and high flows reported on three surveys. Low flow conditions were reported in April. Water coloration was recorded as dark brown on all visits. An earthy odor was reported in February and May.

As in previous years, water depth was not measured at this site during 2013. Monthly transparency values ranged from a low of 33.4 centimeters in June to 92.8 centimeters in January. The annual median value (50.8 centimeters) was the lowest observed among all years of data at this sampling location. All monthly pH values (annual median 5.0 units), were below the 6.0 units minimum state standard. This segment of Second Branch is currently listed as impaired for pH by the state on the impaired waters listing. Monthly

surface temperatures ranged from 4.0 to 20.5^{o}C, varying normally with the seasons. As in the previous year, no individual values exceeded the state standard of 32.0^{o}C during 2013. Dissolved oxygen concentrations ranged from 4.3 mg/L in June to 9.4 mg/L in February with an annual median value of 7.2 mg/L. All of the observations at this station suggest generally fair to good water quality.

Station ID: 14

Site: Unnamed Tributary to the James River at Old Gun Road

Latitude: 37.5543

Longitude: 77.6040

Watershed: James River

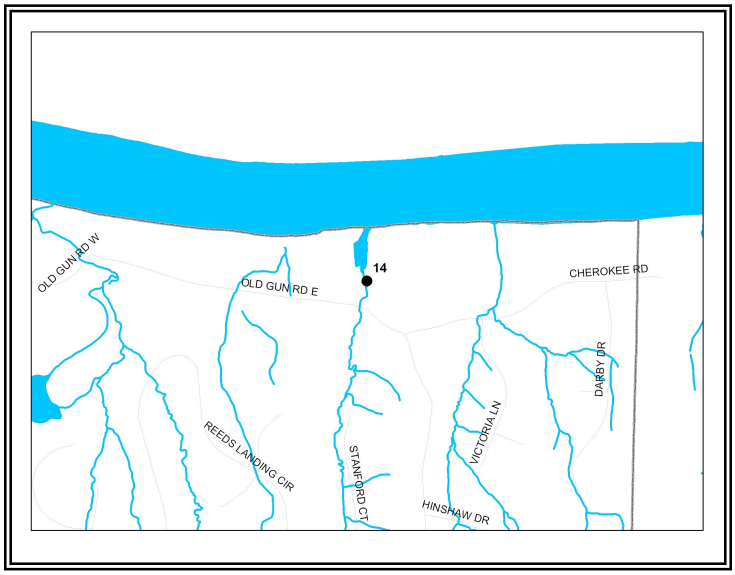
Land use: Residential

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 24.0

Monitoring since: January 2010



This site is located on an unnamed tributary draining directly to the James River in the northern area of Chesterfield County. Water samples were obtained on a monthly basis immediately upstream of the boat slips at the Virginia Powerboat Association property. A total of twelve surveys were conducted during 2013.

Table 1-12. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	9.0	7.0	8.0	6.5	≥120.0	*	*
February	1	15.0	9.0	9.2	6.5	85.0	*	*
March	1	6.0	5.0	8.1	6.5	≥120.0	*	*
April	1	20.0	15.0	6.9	6.8	60.0	*	*
May	1	19.0	17.0	7.1	6.5	15.0	*	*
June	1	28.0	22.0	6.4	6.8	≥120.0	*	*
July	1	21.0	21.0	6.8	6.5	49.0	*	*
August	1	22.0	18.0	7.7	7.0	≥120.0	*	*
September	1	32.0	23.0	7.1	6.8	≥120.0	*	*
October	1	16.0	13.0	8.0	6.8	≥120.0	*	*
November	1	19.0	10.0	10.0	7.0	≥120.0	*	*
December	1	0.0	4.0	9.2	6.8	≥120.0	*	*
Minimum		0.0	4.0	6.4	6.5	15.0	*	*
Median		19.0	14.0	7.9	6.8	≥120.0	*	*
Maximum		32.0	23.0	10.0	7.0	≥120.0	*	*
2012 Annual Median		*21.0*	*14.5*	*8.0*	*7.0*	*≥120.0*	*	*
2011 Annual Median		*13.0*	*10.0*	*8.8*	*7.0*	*≥130.0*	*	*
2010 Annual Median		*16.0*	*17.0*	*7.5*	*7.0*	*≥130.0*	*	*

Sampling of this unnamed tributary to the James River was conducted from January through December of 2013. Seven survey events occurred on clear/sunny days and four were conducted on overcast or partly cloudy days. Showers were recorded for the January survey. High flow conditions were noted on seven of the surveys and low flows were observed on four surveys. One normal flow was recoded on the October survey. Clear waters were present on five surveys. Light or dark brown conditions were recorded during five high flow events. Turbid conditions were recorded on two high flow events.

Algae, leaves and debris were noted during the summer months. Leaves and debris were also noted in December. An earthy odor was scented in July. No other perceptible odors were observed in 2013.

As in previous years, water depth was not measured at this site. Monthly transparency values ranged from a low of 15.0 centimeters in May to ≥120.0 centimeters on most surveys during 2013. The annual median value (≥120.0 centimeters) continued to indicate a high degree of water clarity. All monthly pH values during the year (annual median 6.8 units) were within the 6.0 - 9.0 units state standard range. Monthly median surface temperatures ranged from 4.0 to 23.0^{o}C and varied normally with season. No individual values exceeded the state temperature standard of 32.0^{o}C during 2013. All monthly dissolved oxygen concentrations (annual median 7.9 mg/L) were above state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters. All of the observations at this station continued to suggest excellent water quality.

Station ID: 15

Site: Winterpock Creek at River Road

Latitude: 37.3306

Longitude: 77.7275

Watershed: Appomattox River

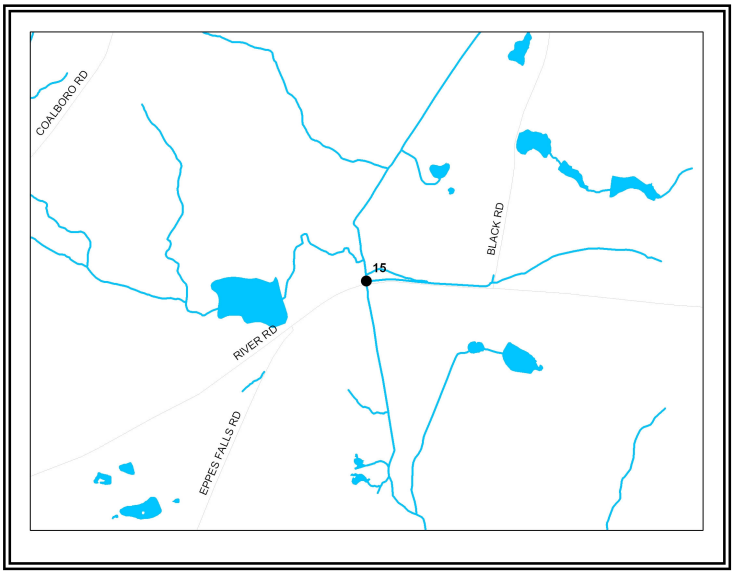
Land use: Rural Residential

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 18.5

Monitoring since: January 2010



This site is located on Winterpock Creek in the southwestern area of Chesterfield County where it crossings River Road. Stream measurements and water samples were obtained once per month approximately six meters upstream of the bridge. A total of twelve surveys were conducted during 2013.

Table 1-13. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	5.0	3.0	8.5	6.0	≥120.0	*	<20
February	1	-1.0	4.5	9.8	6.5	67.0	*	*
March	1	6.0	5.5	9.9	6.0	≥120.0	*	<20
April	1	9.5	11.5	9.2	6.0	≥120.0	*	*
May	1	18.5	15.0	7.0	6.0	86.0	*	<20
June	1	29.5	20.5	5.0	6.5	45.0	*	*
July	1	25.0	22.0	5.1	6.0	51.0	*	340
August	1	23.0	21.5	4.8	6.0	60.0	*	60
September	2	25.8	20.5	3.5	7.0	52.5	*	30
November	1	13.5	10.0	1.3	7.0	35.0	*	*
December	1	7.0	8.0	7.8	6.0	59.0	*	*
	Minimum	-1.0	3.0	1.3	6.0	35.0	*	<20
	Median	13.5	11.5	7.0	6.0	60.0	*	15
	Maximum	29.5	22.0	9.9	7.0	≥120.0	*	340
	2012 Annual Median	*23.3*	*15.8*	*4.7*	*6.5*	*57.0*	*	*<20*
	2011 Annual Median	*20.5*	*14.5*	*5.7*	*6.0*	*75.5*	*	*
	2010 Annual Median	*24.1*	*19.0*	*6.4*	*6.5*	*65.3*	*	*

Sampling of Winterpock Creek was conducted once per month January through December of 2013. Seven survey events occurred during clear/sunny days and four were conducted on overcast or partly cloudy/rainy days. Showers were recorded on one survey. Normal baseflow conditions were noted on seven of the surveys and low flows were observed twice. High flows were observed in February, April and July. Water coloration was typically turbid or light brown with two observations of clear conditions recorded in January and March. Observations of an iron oxide/red appearance were made in June and September, possibly due to the presence of iron bacteria. Leaves/debris were

recorded in May, September and November. There were no perceptible odors recorded during 2013, consistent with previous years.

As in the previous year, water depth was not measured at this site. Monthly median transparency values ranged from a low of 35.0 centimeters in November to ≥120.0 centimeters in January, March and April. The annual median value (60.0 centimeters) was a slight increase over the 2012 median of 57.0 centimeters. All monthly pH values during the year (annual median 6.0 units) were within the 6.0 - 9.0 units state standard range. Monthly surface temperature measurements ranged from 3.0 to 22.0^{o}C and varied normally with season. No temperature values exceeded the state maximum standard of 32.0^{o}C during 2013. Dissolved oxygen concentrations ranged from 1.3 mg/L in November to 9.9 mg/L in March. There were two months when dissolved oxygen concentrations were below state minimum standard of 4.0 mg/L, November (1.3 mg/L) and September (3.5 mg/L). Winterpock Creek has been listed on the state impaired waters list for naturally occurring low dissolved oxygen since 1994. Seven *E. coli* measurements were made at this site in 2013. Samples were incubated for approximately 24 hours at 35^{o}C with resulting densities ranging from <20 to 340 CFU/100ml. One sample (July 340 CFU/100ml) exceeded the 235 CFU/100ml state bacterial standard for recreational contact. Observations from 2013 were consistent with previous years and suggest continued fair water quality at this sampling location.

Station ID: 18

Site: Falling Creek at Belmont Road

Latitude: 37.4435

Longitude: 77.5221

Watershed: Falling Creek

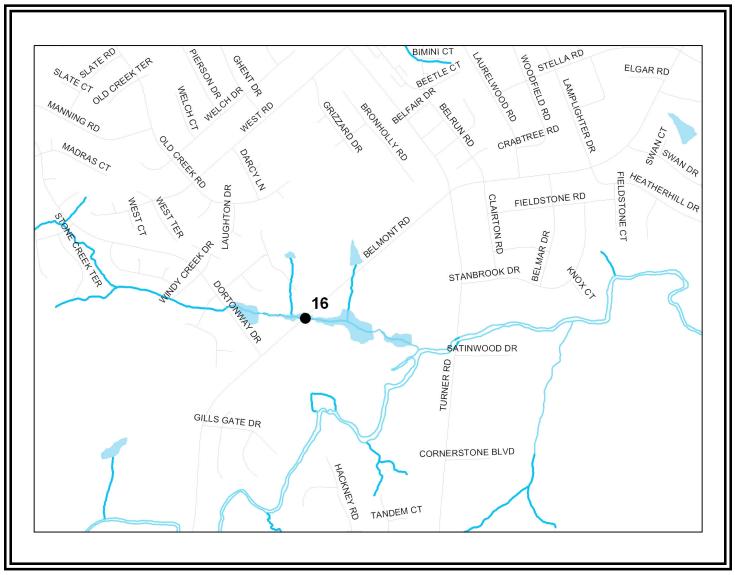
Land use: Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 12.0

Monitoring since: July 2010



This site is located on the mainstem of Falling Creek, one of the major waterways of Chesterfield County. Stream measurements and water samples were obtained at the end of a residential road northwest of Belmont Road on a monthly basis from January to December. A total of twelve surveys were conducted during 2013.

Table 1-14. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	3.0	4.0	9.5	6.5	50.0	2.00	*
February	1	14.0	8.0	9.6	6.5	78.0	1.50	*
March	1	14.0	9.0	9.0	6.5	62.0	1.50	*
April	1	14.0	15.0	7.7	6.5	100.0	1.50	*
May	1	23.0	17.0	6.5	6.5	≥120.0	1.50	*
June	1	27.0	23.0	5.3	6.5	≥120.0	1.30	*
July	1	28.0	26.0	4.6	6.5	≥120.0	1.00	*
August	1	21.0	22.0	6.7	6.0	20.0	4.00	*
September	1	22.0	17.0	6.5	6.5	≥120.0	1.25	*
October	1	20.0	14.0	7.2	6.5	≥120.0	1.00	*
November	1	3.0	4.5	9.9	6.5	≥120.0	1.00	*
December	1	15.0	8.0	9.0	6.5	107.0	0.75	*
	Minimum	3.0	4.0	4.6	6.0	20.0	0.75	*
	Median	17.5	14.5	7.5	6.5	113.5	1.40	*
	Maximum	28.0	26.0	9.9	6.5	≥120.0	4.00	*
	2012 Annual Median	*22.5*	*17.0*	*6.7*	*6.5*	*117.5*	*1.20*	*
	2011 Annual Median	*22.5*	*17.0*	*5.5*	*6.5*	*≥130.0*	*1.35*	*
	2010 Annual Median	*21.0*	*18.5*	*7.9*	*6.8*	*≥130.0*	*0.50*	*

Sampling at this Falling Creek site was conducted from January through December of 2013. Four survey events occurred during clear/sunny days and five were conducted on partly cloudy days. Three surveys noted showers or storms. Normal baseflow conditions were noted eight times and low flows were recorded in July, October and December. High flow conditions were seen in August. Water coloration was recorded as light brown on all surveys except in August when it was noted as muddy, concurrent with the high flow noted that month. Leaves and debris were present on all surveys except two

(January and March). As in previous years, no perceptible odors were scented during 2013.

Monthly transparency values ranged from a low of 20.0 centimeters in August to ≥120.0 centimeters on several occasions. The annual median transparency value (113.5 centimeters) continued to indicate a high degree of water clarity at this location. All monthly pH values during the year (annual median 6.5 units), were within the 6.0 - 9.0 units state standard range. Monthly surface temperatures values ranged from 4.0 to 26.0^{o}C and varied normally with season. No temperature readings exceeded the state maximum standard of 32.0^{o}C during 2013. The annual median value for dissolved oxygen (7.5 mg/L) was indicative of well-oxygenated waters. All monthly dissolved oxygen concentrations were above state minimum standard of 4.0 mg/L. All of the observations at this station continue to suggest excellent water quality.

Station ID: 19

Site: Falling Creek at Kay Road

Latitude: 37.4474

Longitude: 77.4468

Watershed: Falling Creek

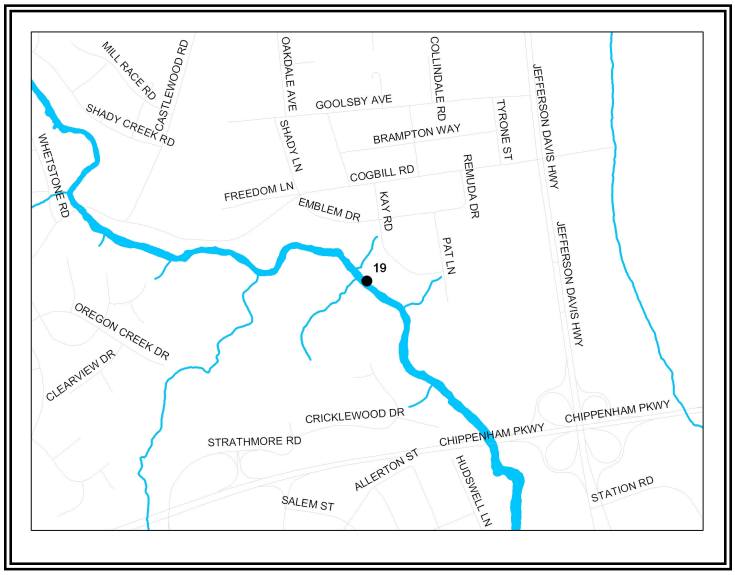
Land use: Residential, County Park

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 10.0

Monitoring since: August 2010



This site is located on the mainstem of Falling Creek, one of the major waterways of Chesterfield County. The site lies adjacent to the county's Falling Creek Park in the northeastern portion of the county. Stream measurements and water samples were obtained once or twice per month during from January through August behind a private residence in the Ranch Acres subdivision. A total of ten surveys were conducted during 2013.

Table 1-15. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	2	14.6	6.0	11.4	6.5	58.7	0.52	*
March	1	6.7	9.0	10.9	6.5	77.0	0.53	*
June	2	30.0	26.0	6.2	6.5	≥120.0	0.57	*
July	1	28.0	26.0	7.5	6.0	68.1	0.64	*
August	1	24.0	26.0	6.7	6.5	86.2	0.53	*
November	2	15.0	11.9	8.7	6.5	≥120.0	0.51	*
December	1	13.0	6.5	11.6	6.5	42.2	0.48	*
	Minimum	6.7	6.0	6.2	6.0	42.2	0.48	*
	Median	15.0	11.9	8.7	6.5	77.0	0.53	*
	Maximum	30.0	26.0	11.6	6.5	≥120.0	0.64	*
	2012 Annual Median	*22.0*	*21.0*	*9.9*	*6.5*	*64.2*	*0.63*	*
	2011 Annual Median	*18.3*	*14.0*	*9.9*	*6.5*	*86.0*	*0.53*	*
	2010 Annual Median	*21.0*	*18.5*	*7.9*	*6.8*	*≥130.0*	*0.50*	*

Sampling at this Falling Creek site was conducted one to two times per month for seven months during 2013. Two surveys were conducted on overcast days. Three surveys occurred during clear/sunny days and five were conducted on partly cloudy days. Normal baseflow conditions were noted during seven of the surveys and high flows were observed during the July survey. Low flows were recorded in November and December. Water coloration was varying shades of brown with a clear appearance recorded in November. As in the previous years, no perceptible odors were observed during 2013.

Water depth at this site ranged from a low of 0.48 meters in December to 0.64 meters in July. The annual median depth for the sampling area was 0.53 meters, a slight decrease from 2012. Individual transparency values ranged from a low of 42.2 centimeters in December to ≥120.0 centimeters during June and November. The annual transparency median of 77.0 centimeters was an improvement over the 2012 median of 64.2 centimeters. All individual pH values (annual median 6.5 units) were within the 6.0 - 9.0 units state standard range. Monthly median surface temperatures ranged from 6.0 to 26.0^{o}C and varied normally with season. No temperature readings exceeded the state standard of 32.0^{o}C during 2013. All individual dissolved oxygen concentrations (annual median 8.7 mg/L) were well above state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters. All of the observations made during 2013 at this station were suggestive of continued excellent water quality.

Station ID: 21

Site: Horner Run at Fernbrook Park

Latitude: 37.4419

Longitude: 77.5648

Watershed: Falling Creek

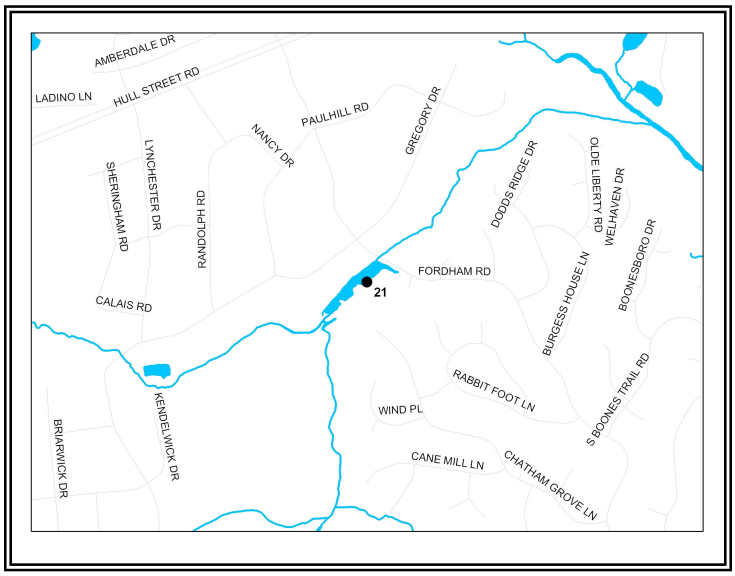
Land use: Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 16.25

Monitoring since: November 2010



This site is located on Horner Run in the central area of Chesterfield County at the county's Fernbrook Park. Water samples were obtained one to two times per month from January through December just north of the picnic shelter. A total of thirteen surveys were conducted during 2013.

Table 1-16. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml)
January	1	14.0	7.0	9.7	6.5	73.0	*	*
February	1	15.5	8.5	10.0	6.5	79.0	*	*
March	1	14.0	9.0	10.9	6.5	77.0	*	*
April	1	15.5	15.5	10.1	6.5	69.0	*	*
May	1	28.0	22.0	7.0	6.5	75.0	*	*
June	2	25.3	24.5	5.6	6.3	24.5	*	*
July	1	28.0	27.0	8.1	7.0	113.0	*	*
August	1	25.0	25.0	5.4	6.5	57.0	*	*
September	1	21.5	20.0	8.6	6.5	≥120.0	*	*
October	1	15.5	15.5	5.5	6.5	96.0	*	*
November	1	12.0	12.0	9.0	6.5	≥120.0	*	*
December	1	11.0	9.0	9.2	6.0	8.0	*	*
	Minimum	11.0	7.0	5.4	6.0	8.0	*	*
	Median	15.5	15.5	8.8	6.5	76.0	*	*
	Maximum	28.0	27.0	10.9	7.0	≥120.0	*	*
	2012 Annual Median	*23.8*	*22.5*	*8.4*	*6.5*	*75.0*	*	*
	2011 Annual Median	*22.3*	*17.8*	*8.7*	*6.5*	*83.5*	*	*

Sampling of Horner Run was conducted thirteen during 2013. Six survey events occurred on clear/sunny days and six were conducted on partly cloudy/overcast days. Showers and light rain were present during the June survey. Normal baseflow conditions were noted on ten of the surveys with the remaining three observations (June, August and December) categorized as high flows. Water coloration was recorded as light brown on most surveys with turbid conditions noted in June and December when the flow rate was noted as high. As in past reports, there were no instances of perceptible odors noted in 2013. Leaves and debris were observed in September and November. Pollen was noted

in May. Fish, turtles and mussels were observed in the stream as well as a variety of waterfowl and songbirds throughout the year.

As in previous years, water depth was not measured at this site during 2013. Monthly transparency values and medians ranged from a low of 8.0 centimeters in December to ≥120.0 centimeters in September and November. The 2013 transparency median of 76.0 centimeters was nearly equal to the 2012 median (75.0 centimeters). All individual pH values and the annual median pH value of 6.5 units were all within the 6.0 - 9.0 unit standard range set by the state and were similar to past observations. Median monthly surface temperatures ranged from a low of 7.0^{o}C in January to a high of 27.0^{o}C in July and varied normally with season. No individual values exceeded the state standard of 32.0^{o}C during 2013. All individual dissolved oxygen concentrations (annual median 8.8 mg/L) were all above the state minimum of 4.0 mg/L and were indicative of well-oxygenated waters. All of the observations made during 2013 at this station were suggestive of continued good water quality.

Station ID: 25

Site: Great Branch at Chalkley Road

Latitude: 37.3620

Longitude: 77.4776

Watershed: Proctors Creek

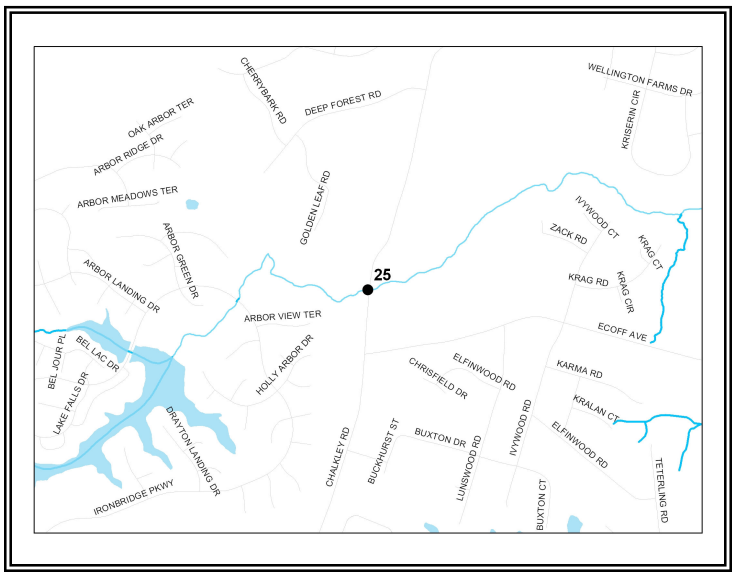
Land use: Residential
Ironbridge Lake

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 6.5

Monitoring since: June 2011



This site is located on the mainstem of Great Branch in the central area of Chesterfield County. Stream measurements and water samples were obtained one to two times per month for five months at the west side of the Chalkley Road culvert along the south bank of the creek. A total of six surveys were conducted during 2013.

Table 1-17. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	10.0	11.0	7.0	6.5	45.0	0.75	*
March	1	9.0	10.0	8.7	6.0	47.0	0.50	*
June	1	26.0	25.0	5.2	6.5	50.0	0.50	*
September	1	24.0	21.0	3.9	6.5	72.0	0.25	*
December	2	13.5	8.0	8.7	6.5	76.0	0.55	*
	Minimum	9.0	8.0	3.9	6.0	45.0	0.25	*
	Median	13.5	11.0	7.0	6.5	50.0	0.50	*
	Maximum	26.0	25.0	8.7	6.5	76.0	0.75	*
	2012 Annual Median	*19.0*	*15.0*	*6.1*	*6.0*	*61.0*	*0.50*	
	2011 Annual Median	*25.0*	*19.5*	*7.6*	*6.0*	*52.0*	*0.30*	*

Sampling of this reach occurred during five months in 2013. Five surveys were conducted on clear/sunny days and one on a partly cloudy day. Low flow conditions were noted on two surveys. Ripples were recorded on four surveys. All surveys recorded water appearance as light to dark brown. All surveys recorded an earthy odor in 2013.

Water depth at this site ranged from 0.25 to 0.75 meters during 2013 with a median depth of 0.50 meters. Transparency values ranged from 45.0 centimeters in January to 76.0 centimeters in December. The 2013 median transparency value of 50.0 centimeters was a decrease from the 2012 median (60.0 centimeters). All individual pH values (annual median 6.5) units were within the 6.0 - 9.0 units state standard range. Surface

temperatures ranged from 8.0 to 25.0^{o}C and varied normally during the year. No temperature measurements in 2013 exceeded the state standard of 32.0^{o}C. The dissolved oxygen annual median was 7.0 mg/L. The dissolved oxygen in September (3.9 mg/L) was a violation of the state minimum standard of 4.0 mg/L. All of the observations made during 2013 at this station were suggestive of continued good water quality.

Station ID: 26

Site: Marine Springs Branch at Kings Farm Drive

Latitude: 37.5518

Longitude: 77.6633

Watershed: James River

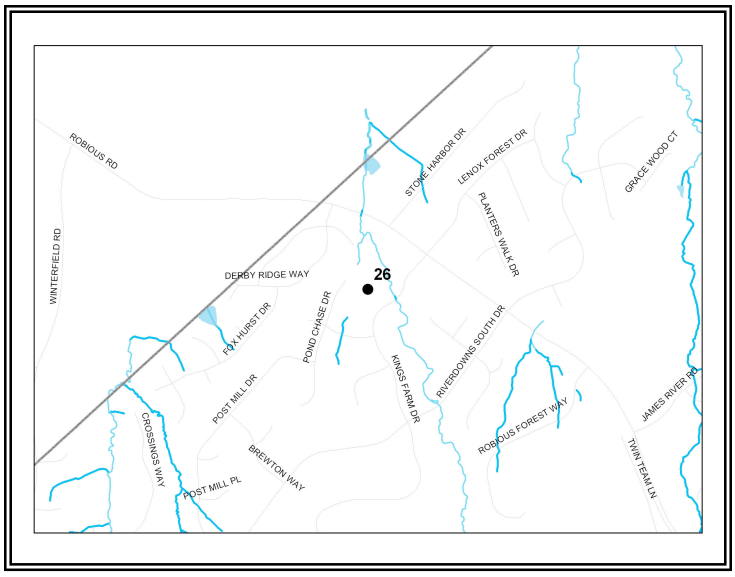
Land use: Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 12.0

Monitoring since: May 2011



This site is located on Marine Springs Branch, a direct drainage to the James River in the northern area of Chesterfield County. Stream measurements and water samples were obtained once per month west of the Kings Farm Drive culvert along the north bank of the creek. A total of twelve surveys were conducted during 2013.

Table 1-18. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	10.0	6.0	10.5	6.0	≥120.0	0.10	<20
February	1	15.0	8.0	10.9	6.5	≥120.0	0.11	<20
March	1	11.0	5.0	11.3	6.0	≥120.0	0.11	<20
April	1	18.0	12.5	9.3	6.0	78.0	0.15	20
May	1	27.5	16.0	8.4	6.0	≥120.0	0.17	<20
June	1	27.0	21.0	8.6	6.0	≥120.0	0.12	40
July	1	31.0	24.0	7.1	6.0	≥120.0	0.07	<20
August	1	26.0	22.0	7.5	7.0	≥120.0	0.09	<20
September	1	25.0	21.0	8.0	7.0	≥120.0	0.05	<20
October	1	28.0	24.0	9.4	6.5	110.0	0.05	40
November	1	17.0	13.0	11.0	6.0	≥120.0	0.08	<20
December	1	15.0	11.0	9.9	6.0	≥120.0	0.10	<20
Minimum		10.0	5.0	7.1	6.0	78.0	0.05	<20
Median		21.5	14.5	9.4	6.0	≥120.0	0.10	<20
Maximum		31.0	24.0	11.3	7.0	≥120.0	0.17	40
2012 Annual Median		*21.0*	*14.0*	*8.9*	*6.5*	*≥130.0*	*0.13*	*55*
2011 Annual Median		*23.5*	*19.5*	*9.8*	*7.0*	*≥130.0*	*0.24*	*

Surveys were conducted at Marine Springs Branch once per month from January through December of 2013. Clear/sunny conditions were present on six of the surveys and overcast conditions were recorded on five surveys. One survey, November, recorded light showers. Normal baseflow conditions were noted on seven of the surveys and low flow was recorded on four surveys. High flow was recorded on the April survey after a day of rain. Clear water conditions were observed on all surveys in 2013. Leaves and debris were recorded in November. There were no perceptible odors present during 2013.

Water depth at this site ranged from 0.05 to 0.17 meters during 2013 with an annual median depth of 0.10 meters. Most transparency values were ≥120.0 centimeters. The 2013 median transparency was ≥120.0 centimeters and is consistent with previous years. All individual pH values (annual median 6.0 units) were within the 6.0 - 9.0 units state standard range. Surface temperatures ranged from 5.0 to 24.0^{o}C and varied normally with season. No temperature measurements in 2013 exceeded the state standard of 32.0^{o}C. All monthly dissolved oxygen concentrations (annual median 9.4 mg/L) were above the state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters. Monthly *E. coli* measurements were made at this site during 2013. Samples were incubated for approximately 50 hours at 20^{o}C with resulting densities ranging from <20 to 40 CFU/100ml. There were no instances when *E. coli* values exceeded the 235 CFU/100ml VADEQ state bacterial standard for recreational contact unlike in 2012 when there were three recorded violations. All of the observations made during 2013 at this station were suggestive of continued good water quality.

Station ID: 28

Site: Oldtown Creek at Branders Bridge Road

Latitude: 37.2618

Longitude: 77.4239

Watershed: Appomattox River

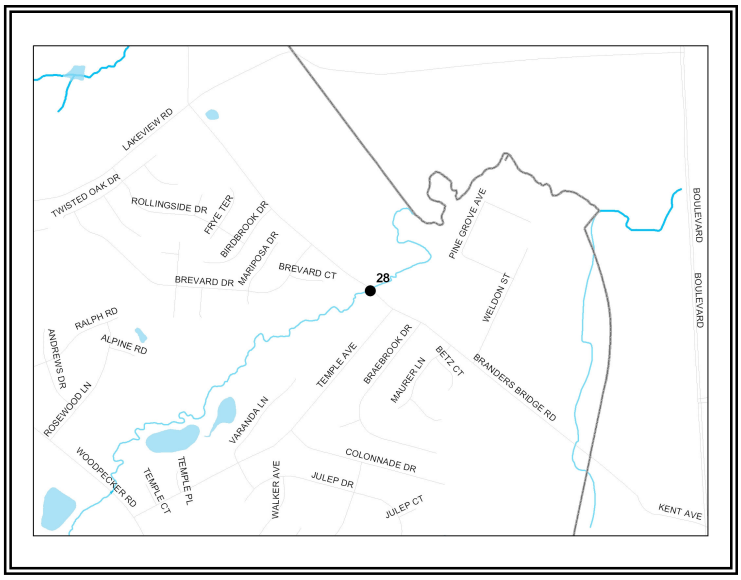
Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 5.5

Monitoring since: December 2011



This site is located on the mainstem of Oldtown Creek, which drains to the Appomattox River in the southeastern area of Chesterfield County. Stream measurements and water samples were obtained once per month from January through December immediately upstream of the Branders Bridge Road crossing. A total of eleven surveys were conducted during 2013.

Table 1-19. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	23.0	10.0	10.1	6.0	64.0	*	*
February	1	15.0	7.0	11.1	6.0	33.2	*	*
March	1	18.0	10.0	15.0	6.0	40.0	*	*
May	1	25.0	21.0	9.9	6.0	40.0	*	*
June	1	24.0	24.0	9.2	6.0	46.0	*	*
July	1	24.0	23.5	9.8	6.0	28.0	*	*
August	1	32.0	24.5	8.1	6.5	51.0	*	*
September	1	27.0	17.5	6.5	6.0	36.0	*	*
October	1	23.0	14.5	8.7	6.0	58.4	*	*
November	1	8.0	5.0	12.2	6.0	55.0	*	*
December	1	7.0	4.0	11.5	6.5	59.0	*	*
	Minimum	7.0	4.0	6.5	6.0	28.0	*	*
	Median	23.0	14.5	9.9	6.0	46.0	*	*
	Maximum	32.0	24.5	15.0	6.5	64.0	*	*
	2012 Annual Median	*21.0*	*14.8*	*10.0*	*6.0*	*52.0*	*	*

Sampling at Oldtown Creek occurred from January through December of 2013. Seven surveys were conducted during clear/sunny days and three were conducted on overcast or partly cloudy days. Rain was noted on the July survey. Normal baseflow conditions were noted during six surveys and high flows were noted in January, February, March and July. Low flow conditions were observed in September. Water coloration was recorded as either light or dark brown on all visits except September when the coloration was recorded as green. Leaves and debris were observed four times. No odors were

noted in 2013 except for September, which was recorded as earthy, when the flow was noted as low and the coloration was recorded as green.

Water depth was not measured at this site during 2013. Transparency values ranged from a low of 28.0 centimeters in July to a high of 64.0 centimeters in January. The annual median transparency value was 46.0 centimeters and was indicative of reduced water clarity. All individual pH values (annual median of 6.0 units) were within the 6.0 - 9.0 units state standard range. Surface temperatures varied normally according to season and ranged from 4.0 to 24.5^{o}C. No temperature measurements exceeded the state standard of 32.0^{o}C. Dissolved oxygen concentrations ranged from a low of 6.5 mg/L in September to 15.0 mg/L in March with a resulting annual median value observed at 9.9 mg/L. The annual median value was one of the greatest observed at all sites in 2013 and indicated highly oxygenated waters. No observations of dissolved oxygen fell below the state minimum of 4.0 mg/L. The reduced clarity observed combined with the excellent pH, temperature and dissolved oxygen measurements were suggestive of very good water quality at this site.

Station ID: 29

Site: Otterdale Branch at Lake Summer Place

Latitude: 37.4416

Longitude: 77.7119

Watershed: Swift Creek Reservoir

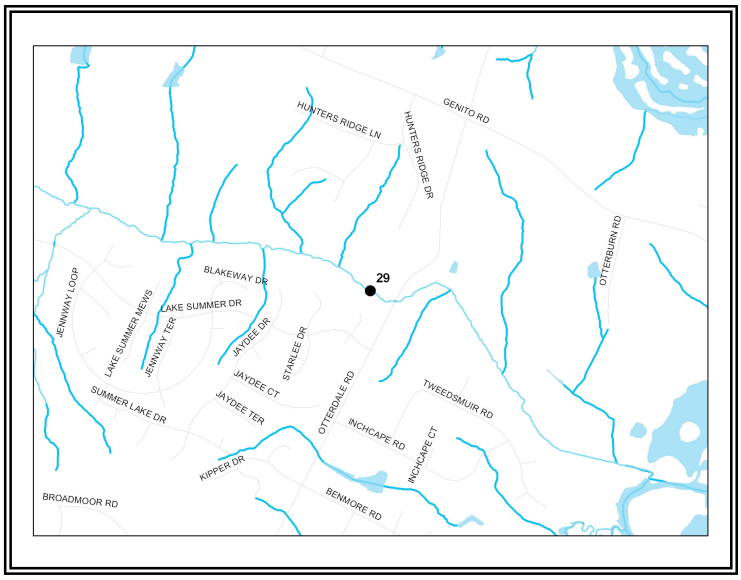
Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 10.0

Monitoring since: November 2011



This site is located on Otterdale Branch, a major drainage to the Swift Creek Reservoir located in the northwestern portion of Chesterfield County. Stream measurements and water samples were obtained once/twice per month from January through December just off the pedestrian trail located behind 4400 Lake Summer Place. A total of ten surveys were conducted during 2013.

Table 1-20. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	7.5	4.5	10.8	6.5	41.6	*	*
February	1	14.5	10.5	9.6	6.5	≥120.0	*	*
March	1	18.5	11.5	9.1	6.5	46.4	*	*
April	1	19.5	15.5	7.3	6.5	59.8	*	*
May	1	29.5	20.5	6.0	6.5	105.8		
June	1	28.0	23.0	6.0	6.5	68.2	*	*
July	1	32.2	24.5	5.9	6.5	70.1		
August	1	30.0	23.3	6.1	6.5	97.6	*	*
October	1	18.0	16.0	6.0	6.5	76.0	*	*
December	1	10.5	5.5	10.4	6.5	111.8	*	*
	Minimum	7.5	4.5	5.9	6.5	41.6	*	*
	Median	19.0	15.8	6.7	6.5	73.1	*	*
	Maximum	32.2	24.5	10.8	6.5	≥120.0	*	*
	2012 Annual Median	*18.5*	*14.5*	*5.8*	*6.5*	*105.0*	*	*

Surveys were conducted at Otterdale Branch for ten months from January through December of 2013. Six surveys occurred on clear/sunny days and three surveys noted overcast conditions. One survey in October noted light showers. Normal baseflow conditions were noted five times and high flows were noted four times. Low flow conditions were noted in May. Clear water was noted on three surveys and seven surveys noted brown/turbid conditions. In addition to being turbid, a milky appearance was noted in March and April. An earthy odor was noted in December. No other perceptible odors were recorded during the year.

Water depth was not measured at this site during 2013. Water clarity, as measured by transparency, ranged from a low of 41.6 centimeters in January to ≥120.0 centimeters in February. The annual median value was calculated as 73.1 centimeters. All pH values (annual median of 6.5 units) were within the 6.0 - 9.0 units state standard range. Surface temperatures ranged from 4.5 to 24.5^{o}C and varied normally with season. No temperature measurement in 2013 exceeded the state standard of 32.0^{o}C. All monthly dissolved oxygen concentrations (annual median 6.7 mg/L) were above state minimum standard of 4.0 mg/L and were indicative of adequately oxygenated waters. Overall measurements at this site were characteristic of good water quality.

Station ID: 30

Site: West Branch at Prescotts Level

Latitude: 37.4086

Longitude: 77.7132

Watershed: Swift Creek Reservoir

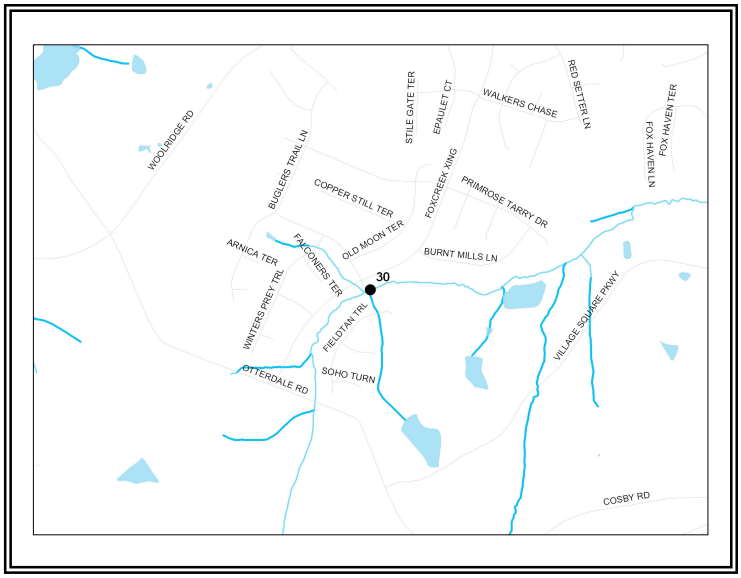
Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 11.0

Monitoring since: January 2012



This site is located on West Branch, a major drainage to the Swift Creek Reservoir located in the northwestern portion of Chesterfield County. Water samples were obtained once per month from January through December along the south bank of the stream immediately west of the Prescotts Level culvert. A total of eleven surveys were conducted during 2013.

Table 1-21. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	10.0	4.5	11.0	6.5	48.5	*	*
February	1	14.5	9.5	9.5	6.5	≥120.0	*	*
March	1	17.5	11.5	9.7	6.5	110.4	*	*
April	1	21.0	16.0	7.6	6.5	95.0	*	*
May	1	27.0	23.0	5.7	6.0	95.8	*	*
June	1	28.0	23.0	5.1	6.5	97.8	*	*
July	1	32.0	25.5	6.0	6.5	77.5	*	*
August	1	30.0	23.5	6.6	6.5	61.5	*	*
October	1	18.0	17.0	6.3	6.5	12.5	*	*
November	1	9.0	5.5	7.7	6.5	≥120.0	*	*
December	1	9.0	6.0	10.1	6.5	≥120.0		
	Minimum	9.0	4.5	5.1	6.0	12.5	*	*
	Median	18.0	16.0	7.6	6.5	95.8	*	*
	Maximum	32.0	25.5	11.0	6.5	≥120.0	*	*
	2012 Annual Median	*25.1*	*17.9*	*6.6*	*6.5*	*≥130.0*	*	*

Surveys were conducted at West Branch for eleven months from January through December of 2013. Eight survey events occurred on clear/sunny days and two surveys occurred on partly cloudy or overcast days. One survey (October), was conducted during light showers. Normal baseflow conditions were noted on six surveys and low flow was observed in May, August and November. High flows were recorded in January and October. Clear water was noted on four surveys and light brown conditions were noted the rest of the year. In addition, a milky appearance was noted in January and August. No perceptible odors were recorded during 2013.

Water depth was not measured at this site during 2013. Water clarity, as measured by transparency, ranged from a low of 12.5 centimeters in October to ≥120.0 centimeters in February, November and December. The annual median transparency value was calculated as 95.8 centimeters and represents a decline from 2012 median (>130.0 centimeters). All pH values (annual median 6.5 units) were within the 6.0 - 9.0 units state standard range and varied little throughout the year. Surface temperatures ranged from 4.5 to 25.5^{o}C and varied normally with season. No temperature measurement in 2013 exceeded the state standard of 32.0^{o}C. All monthly dissolved oxygen concentrations (annual median of 7.6 mg/L) were above the state minimum standard of 4.0 mg/L and represented an improvement over the 2012 median (6.6 mg/L). Overall measurements at this site were characteristic of very good water quality.

Station ID: 34

Site: Second Branch at Nash Road

Latitude: 37.3221

Longitude: 77.5573

Watershed: Swift Creek

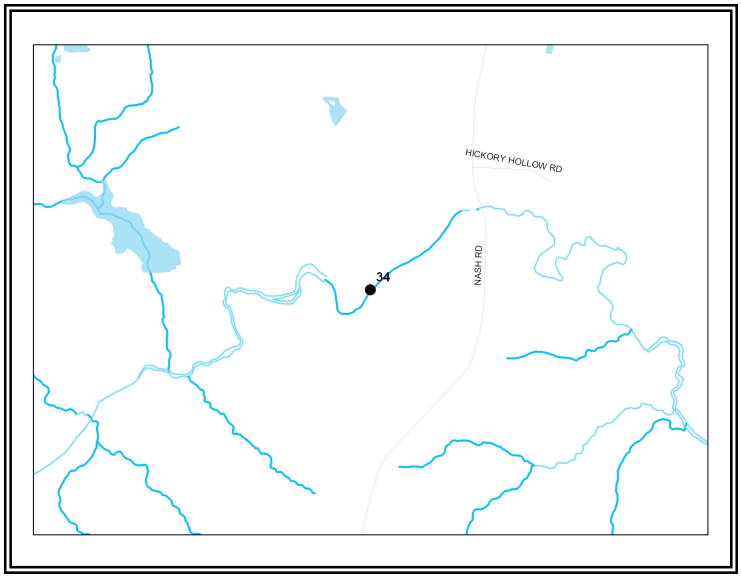
Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 12.0

Monitoring since: March 2012



This site is located on Second Branch in the south central area of Chesterfield County at its crossing with Nash Road. Stream measurements and water samples were obtained once or twice per month from January through December. The site is located at the end of the path immediately behind 12900 Nash Road along the south bank of the stream. A total of twelve surveys were conducted during 2013.

Table 1-22. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	1	27.0	12.0	10.0	5.0	82.4	1.20	*
February	1	15.0	10.0	10.0	5.0	76.2	1.20	*
March	1	16.0	9.0	10.0	4.5	70.0	0.90	*
April	1	30.0	21.0	8.0	6.5	70.2	1.20	*
May	1	20.0	17.0	9.9	6.5	59.0	1.20	*
June	1	23.0	19.0	9.1	6.5	66.0	0.90	*
July	1	24.0	23.0	9.7	6.5	39.2	1.10	*
September	2	19.8	19.5	10.0	6.3	92.1	1.00	*
October	1	19.0	16.0	9.5	6.5	103.8	0.90	*
November	1	18.0	4.0	11.7	6.0	72.4	0.90	
December	1	16.0	7.0	10.1	6.5	20.0	1.40	
	Minimum	15.0	4.0	8.0	4.5	20.0	0.90	*
	Median	19.8	16.0	10.0	6.5	70.2	1.10	*
	Maximum	30.0	23.0	11.7	6.5	103.8	1.40	*
	2012 Annual Median	*23.0*	*17.0*	*9.7*	*5.0*	*55.0*	*1.16*	*

Surveys were conducted at this Second Branch reach once or twice per month from January through December of 2013. Nine survey events occurred on clear/sunny or partly cloudy days. Two surveys occurred on overcast days and rain was noted on one survey. Normal baseflow conditions were noted on eleven surveys. High flow conditions were noted in December after a day of rain. Water coloration was recorded as either light or dark brown on all but one survey. A milky appearance was noted in December. Leaves and debris were noted in October, November and December. No perceptible odors were recorded during 2013.

Water depth at this site ranged from 0.90 to 1.40 meters during 2013 with an annual median depth of 1.10 meters. Water clarity, as measured by transparency, ranged from a low of 20.0 centimeters in December to a high of 103.8 centimeters in October. The annual median transparency value was calculated at 70.2 centimeters and was an increase over the 2012 median of 55.0 centimeters. Measurements of pH ranged from 4.5 to 6.5 units with an annual median of 6.5 units. Three monthly pH values were below the 6.0 unit state standard set but the annual median was an improvement over the 2012 annual median (5.0 units). Second Branch has been listed on the state's impaired waters list since 2010 for "naturally occurring" low pH. Surface temperatures ranged from 4.0 to 23.0^{o}C and were normal with the seasons. No temperature measurement in 2013 exceeded the state standard of 32.0^{o}C. All individual dissolved oxygen concentrations (annual median 10.0 mg/L) were above the state minimum of 4.0 mg/L and were indicative of highly oxygenated waters. The improved transparency and pH together with the excellent oxygen levels suggest overall good water quality.

Station ID: 35

Site: Swift Creek at Pocohontas State Park

Latitude: 37.3898

Longitude: 77.5759

Watershed: Swift Creek

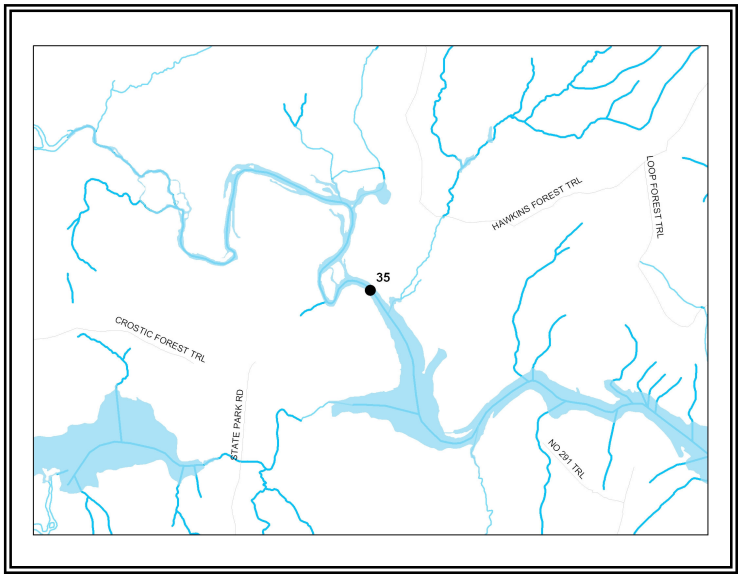
Land use: Residential, Commercial, Forest, Park

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 8.0

Monitoring since: March 2012



This site is located on the mainstem of Swift Creek, one of the major waterways of Chesterfield County. The site lies within the confines of Pocohontas State Park in the central portion of Chesterfield County. Stream measurements and water samples were obtained from Swift Creek once or twice per month from February through July at the pedestrian bridge where the creek joins with Swift Creek Lake. A total of six surveys were conducted during 2013.

Table 1-23. Monthly values and annual medians for each water quality parameter measured during 2013.

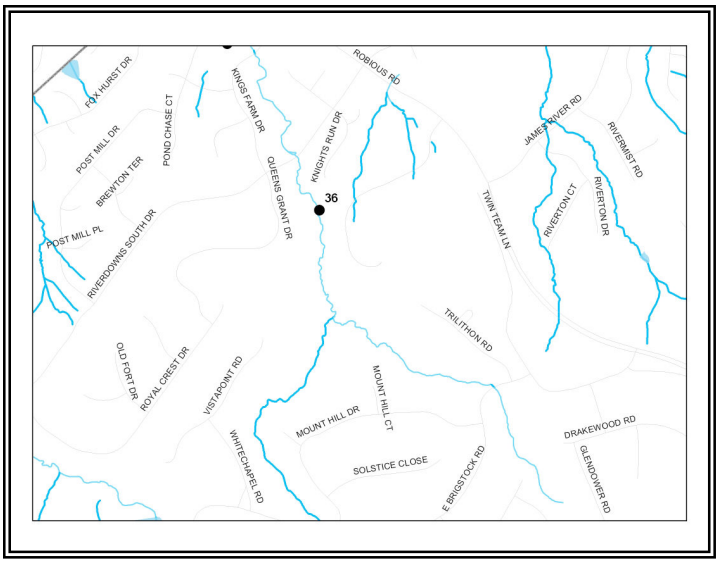
Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
February	1	15.0	6.0	9.9	6.5	88.0	2.70	*
March	2	13.5	7.0	10.1	6.5	108.5	2.85	*
May	1	20.0	16.0	7.4	6.5	≥120.0	2.90	*
June	1	32.0	24.0	6.1	6.5	56.0	2.80	*
July	1	35.0	27.0	5.6	6.5	76.0	2.80	*
	Minimum	13.5	6.0	5.6	6.5	56.0	2.70	*
	Median	20.0	16.0	7.4	6.5	88.0	2.80	*
	Maximum	35.0	27.0	10.1	6.5	≥120.0	2.90	*
	2012 Annual Median	*25.0*	*21.0*	*7.5*	*6.5*	*90.5*	*2.70*	*

Surveys were conducted at this Swift Creek reach over a five month period during 2013. Two surveys occurred on clear/sunny and four surveys were conducted on partly cloudy or overcast days. The water surface was noted as having ripples on four surveys and was noted as calm in March. Water coloration was noted as varying degrees of green or brown hues. Additionally, a milky appearance was noted in May. Leaves and debris were frequently recorded in June and July. Pollen was noted in May. Earthy odors were recorded in June and July.

Water depth at this site ranged from 2.70 to 2.90 meters during the monitoring period with a median depth of 2.80 meters. Water clarity, as measured by transparency, ranged

from a low of 56.0 centimeters in June to a high of ≥120.0 centimeters in May. The annual median transparency value was calculated at 88.0 centimeters and was indicative of good water clarity. All pH values (annual median 6.5 units) were within the 6.0 - 9.0 units state standard range. Surface temperatures ranged from 6.0 to 27.0°C and were normal for the time of the year. No recorded surface temperatures exceeded the state standard of 32.0^{o}C. All monthly dissolved oxygen concentrations (annual median 7.4 mg/L) were above the state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters. All of the observations made during 2013 at this station were suggestive of continuing good water quality.

Station ID: 36



Site: Marine Springs Branch at Knights Run Drive

Latitude: 37.5465

Longitude: 77.6597

Watershed: James River

Land use: Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 11.0

Monitoring since: August 2012

This site is located on Marine Springs Branch, a direct drainage to the James River in the northern area of Chesterfield County. Stream measurements and water samples were obtained once per month from July through December. The site is approximately 75 meters southwest of 13800 Knights Run Drive. A total of six surveys were conducted during 2013.

Table 1-24. Monthly values and annual medians for each water quality parameter measured during 2013.

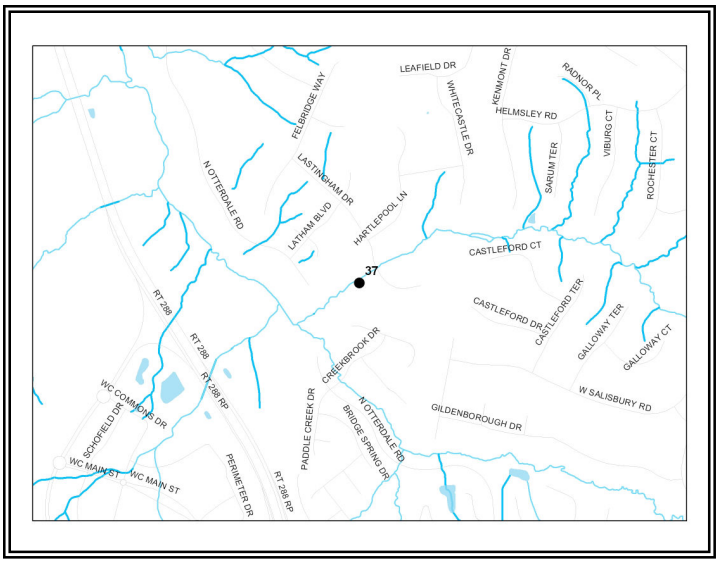
Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
July	1	28.0	19.0	7.8	7.0	≥120.0	0.19	*
August	1	29.0	19.0	8.3	7.0	≥120.0	0.19	*
September	1	27.0	19.0	6.6	6.5	≥120.0	0.14	*
October	1	15.0	11.0	7.8	7.0	≥120.0	0.12	*
November	1	15.0	11.0	8.9	7.0	≥120.0	0.12	*
December	1	14.0	7.0	8.5	7.0	≥120.0	0.22	
	Minimum	14.0	7.0	6.6	6.5	≥120.0	0.12	*
	Median	21.0	15.0	8.0	7.0	≥120.0	0.17	*
	Maximum	29.0	19.0	8.9	7.0	≥120.0	0.22	*
	2012 Annual Median	*16.0*	*13.5*	*7.8*	*7.0*	*≥130.0*	*0.15*	*

Surveys were conducted at this Marine Springs Branch site for six months beginning in July. Two surveys occurred on clear/sunny days. Four surveys were conducted on partly cloudy or overcast days. The water surface was noted as having ripples on five visits. The surface was noted as calm in March. Water coloration was noted as varying degrees of brown throughout the sampling period. Additionally, green hues were noted in March and May. Leaves and debris were noted on four surveys. Trash was noted in August and October. Algae were noted in August. One earthy odor noted in September and all other surveys recorded the no perceptible odors were present. Minnows, crayfish and waterbugs were noted on several surveys.

Water depth ranged from 0.12 to 0.22 meters. The monitoring period median depth was 0.17 meters. All individual transparency measurements were ≥120.0 centimeters and

were indicative of a high degree of water clarity. All pH values (annual median 7.0 units) were within the 6.0 - 9.0 units state standard range. Surface temperatures ranged from 7.0 to 19.0^{o}C and were normal for the time of the year. No temperature measurement in 2013 exceeded the state standard of 32.0^{o}C. All individual dissolved oxygen concentrations (annual median 8.0 mg/L) were well above the state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters. All of the observations made during 2013 at this station were suggestive of excellent water quality.

Station ID: 37



Site: Tributary to Michaux Creek at Lastingham Drive

Latitude: 37.5223

Longitude: 77.6843

Watershed: James River

Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 30.0

Monitoring since: August 2012

This site is located on a tributary to Michaux Creek, a direct drainage to the James River in the northern area of Chesterfield County. Stream measurements and water samples were obtained one to four times per month from January to December at Lastingham Drive. A total of thirty surveys were conducted during 2013.

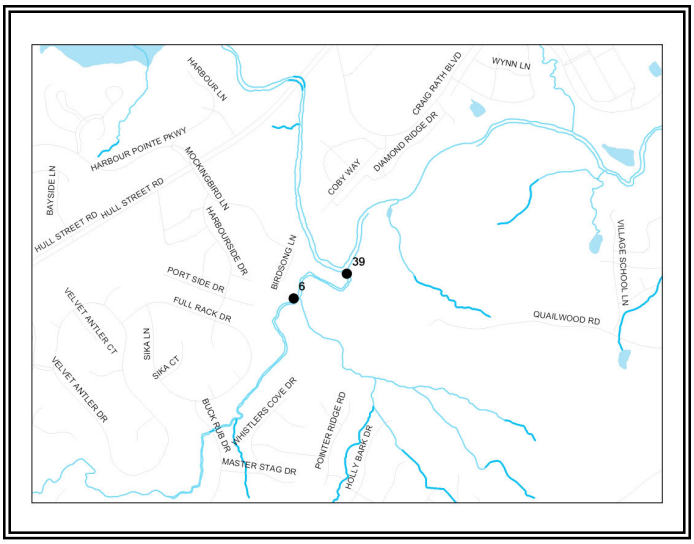
Table 1-25. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	3	15.5	14.5	9.7	6.5	≥120.0	1.00	*
February	2	15.3	10.0	10.4	6.5	≥120.0	1.00	*
March	3	14.5	10.5	10.9	6.5	≥120.0	1.00	*
April	2	18.5	13.8	10.2	6.5	≥120.0	0.88	*
May	3	27.5	19.5	9.3	6.5	≥120.0	0.50	*
June	1	27.5	23.0	8.0	6.5	≥120.0	1.00	*
July	3	24.5	21.5	7.3	6.5	≥120.0	0.50	*
August	3	25.0	21.0	7.2	6.5	≥120.0	0.50	*
September	2	25.0	20.0	7.9	6.5	≥120.0	0.75	*
October	3	21.0	17.5	8.4	6.5	≥120.0	1.00	*
November	1	12.5	6.0	10.3	6.5	≥120.0	1.00	*
December	4	12.5	9.8	10.4	6.5	≥120.0	0.88	*
Minimum		12.5	6.0	7.2	6.5	≥120.0	0.50	*
Median		19.8	16.0	9.5	6.5	≥120.0	0.94	*
Maximum		27.5	23.0	10.9	6.5	≥120.0	1.00	*
2012 Annual Median		*19.0*	*15.5*	*8.6*	*6.5*	*≥130.0*	*1.00*	*

Surveys were conducted at the tributary to Michaux Creek reach for twelve months beginning in January. Fifteen survey events occurred on clear/sunny days and twelve surveys occurred on partly cloudy days. Rain or showers were noted on three surveys. Normal baseflow conditions were noted on 23 surveys. Low conditions were noted on five surveys. High flows were noted in January and again in December. The stream's water was clear on most monitoring visits except January when it was noted as milky and December when it was recorded as light brown. Leaves and debris were observed during in October. There were no perceptible odors recorded during 2013.

Water depth ranged from a low of 0.50 meters to of 1.0 meters. The 2013 median depth was 0.94 meters. The annual median transparency was ≥120.0 centimeters and was indicative of a high degree of water clarity. All pH values (annual median 6.5 units) were within the 6.0 - 9.0 units state standard range. Surface temperatures ranged from 6.0 to 23.0^{o}C and were normal for the time of the year. No temperature measurement in 2013 exceeded the state standard of 32.0^{o}C. All individual oxygen concentrations (annual median 9.5 mg/L) were above the state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters. All of the observations made during 2013 at this station were suggestive of continuing excellent water quality.

Station ID: 39



Site: Spring Run at Mockingbird Lane

Latitude: 37.4081

Longitude: – 77.6419

Watershed: Appomattox

Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 12.0

Monitoring since: September 2012

This site is located on Spring Run in the west central area of Chesterfield County near its confluence with Swift Creek. Water samples were obtained two to three times per month for nine months in 2013. A total of twelve surveys were conducted during 2013.

Table 1-26. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
January	3	10.0	5.0	11.0	7.0	≥120.0	*	*
February	2	3.8	6.8	10.7	6.5	90.5	*	*
March	1	4.0	9.0	9.7	6.5	65.3	*	*
April	1	22.5	18.5	8.8	7.0	89.0	*	*
May	1	20.0	17.0	4.7	6.0	≥120.0	*	*
June	1	24.0	26.5	4.0	6.5	≥120.0	*	*
August	1	23.0	25.0	3.4	6.5	≥120.0	*	*
September	1	18.0	17.5	5.6	7.0	≥120.0	*	*
December	1	13.5	14.0	8.5	7.0	≥120.0	*	*
	Minimum	3.8	5.0	3.4	6.0	65.3	*	*
	Median	18.0	17.0	8.5	6.5	≥120.0	*	*
	Maximum	24.0	26.5	11.0	7.0	≥120.0	*	*
	2012 Annual Median	*15.8*	*14.3*	*6.4*	*7.0*	*≥130.0*	*	*

Surveys were conducted at this Spring Run reach for nine months beginning in January 2013. Five surveys occurred on clear/sunny days and seven surveys occurred on partly cloudy or overcast days. Normal baseflow conditions were noted on four surveys and high flows were noted most of the year (n=7). Low flow conditions were noted in May. Water coloration was described as varying shades of brown throughout the year. A milky appearance was noted eight times. A foamy presence was noted five times in four months (February, March, April and December). Leaves and debris were observed during all visits. Trash was noted six times. Earthy odors were present during the first three months of the year and a fishy odor was recorded in April.

Water depth was not measured at this site during 2013. Most of the monthly transparency measurements were ≥120.0 centimeters. The 2013 annual median transparency was ≥120.0 centimeters. All individual pH measurements (annual median

6.5 units) were within the 6.0 - 9.0 units state standard range. Surface temperatures ranged from 5.0 to 26.5°C and were normal for the time of the year. No temperature measurement in 2013 exceeded the state standard of 32.0°C. One monthly dissolved oxygen measurement (August 3.4 mg/L) was below the state minimum standard of 4.0 mg/L and occurred when water temperatures were elevated. Dissolved oxygen values were above the state standard minimum throughout the rest of the year. The 2013 median for dissolved oxygen was 8.5 mg/L, an increase from the 2012 median of 6.4 mg/L. All of the observations made during 2013 at this station were suggestive of continued excellent water quality.

Station ID: 41

Site: Tributary to Falling Creek at Queensgate Road

Latitude: 37.4865

Longitude: -77.6403

Watershed: Falling Creek

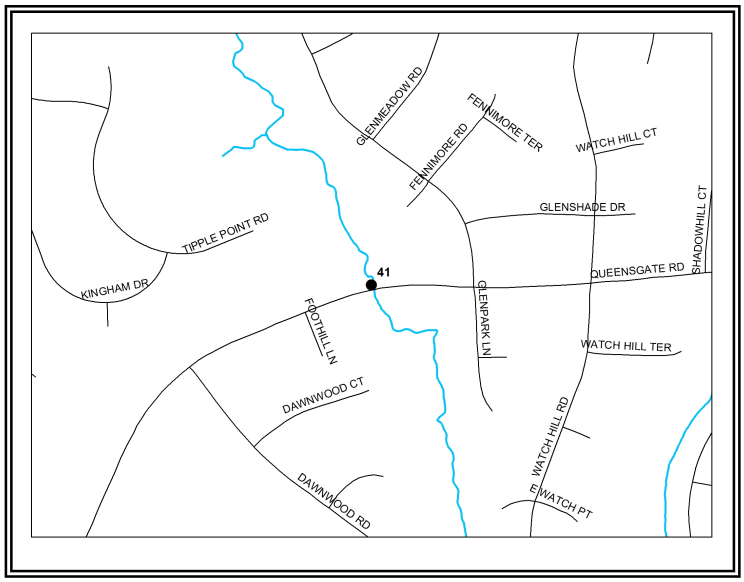
Land use: Residential, School

Number of Stations: 1

Volunteer Hours: 10.0

Number of Monitors: 1

Monitoring since: July 2013



This site is located on an unnamed tributary to Falling Creek the north central area of Chesterfield County. Water samples were obtained once per month for five months in 2013. A total of five surveys were conducted during 2013.

Table 1-27. Monthly values and annual medians for each water quality parameter measured during 2013.

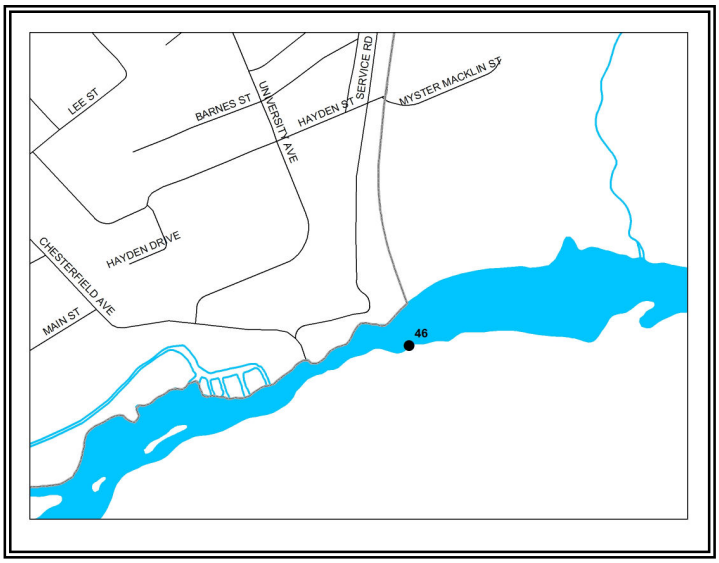
Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
July	1	21.0	24.0	6.4	6.5	80.0	*	220
August	1	24.0	22.0	7.0	6.5	90.0	*	60
October	1	26.0	19.0	6.1	6.5	85.0	*	60
November	1	7.0	5.0	6.7	6.5	70.0	*	60
December	1	8.0	7.0	10.3	6.5	37.0	*	*
	Minimum	7.0	5.0	6.1	6.5	37.0	*	60
	Median	21.0	19.0	6.7	6.5	80.0	*	60
	Maximum	26.0	24.0	10.3	6.5	90.0	*	220

Surveys were conducted at this site for five months beginning in July 2013. Four surveys occurred on partly cloudy days and one occurred on a sunny day. High flows were recorded on two surveys and low/negligible flows were recorded on three surveys. Water coloration was described as clear on three surveys and light brown on two surveys. A milky appearance was noted in December. Leaves and debris were observed during all visits. No perceptible odors were recorded in 2013.

Water depth was not measured at this site during 2013. Monthly transparency measurements ranged from a low of 37.0 centimeters in December to a high of 90.0 centimeters in August. The 2013 median transparency value of 80.0 centimeters was indicative of reduced clarity. All individual pH measurements (annual median 6.7 units) were within the 6.0 - 9.0 units state standard range. Surface temperatures ranged from 5.0 to 24.0°C and were normal for the time of the year. No temperature measurement in 2013 exceeded the state standard of 32.0°C. All individual dissolved oxygen concentrations (annual median 6.7 mg/L) were above state minimum standard of 4.0

mg/L and were indicative of well-oxygenated waters. Monthly *E. coli* measurements were made at this site during 2013. Samples were incubated for approximately 48 hours at 25^{o}C with resulting densities ranging from 60 to 220 CFU/100ml. There were no instances when *E. coli* values exceeded the 235 CFU/100ml VADEQ state bacterial standard for recreational contact. This site was monitored for the first time in 2013. Initial observations made during 2013 at this station were suggestive of good water quality.

Station ID: 46



Site: Appomattox River in Ettrick, VA

Latitude: 37.2328

Longitude: -77.4158

Watershed: Appomattox River

Land use: Commercial, Urban

Number of Stations: 1

Volunteer Hours: 7.0

Number of Monitors: 1

Monitoring since: October 2013

This site is located on the Appomattox River on the northern border of Petersburg. Water samples were obtained once or twice per month for three months in 2013. A total of four surveys were conducted during 2013.

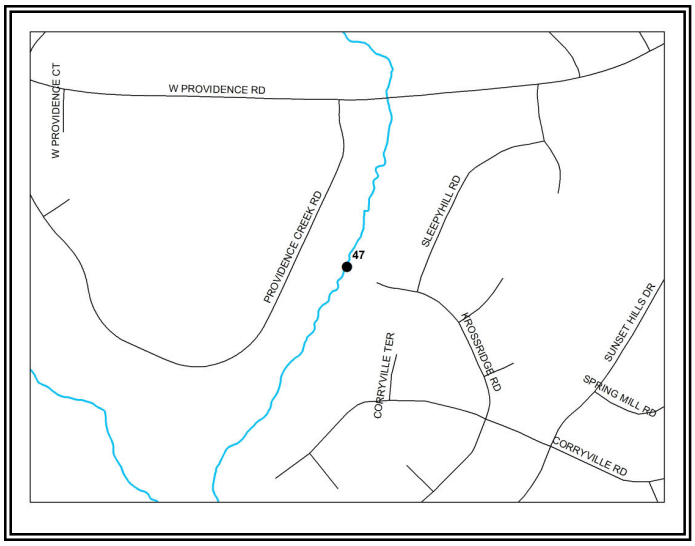
Table 1-28. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
October	2	24.0	19.5	7.2	8.0	≥120.0	*	*
November	1	2.0	10.0	11.1	8.0	≥120.0	*	*
December	1	7.0	9.0	11.1	7.5	72.4	*	*
	Minimum	2.0	9.0	7.2	7.5	72.4	*	*
	Median	7.0	10.0	11.1	8.0	≥120.0	*	*
	Maximum	24.0	19.5	11.1	8.0	≥120.0	*	*

Surveys were conducted at this site for three months beginning in October 2013. All surveys occurred on clear/sunny days. Normal baseflow conditions were recorded on all surveys. Water coloration was described as light brown to green on most surveys. A turbid condition was noted in December. Leaves and debris were observed on three surveys. An alga was recorded in December. An earthy odor was recorded in November.

Water depth was not measured at this site during 2013. An individual transparency value of 72.4 centimeters was recorded in December. All other transparency readings were ≥120.0 centimeters. The 2013 annual median transparency value of ≥120.0 centimeters was indicative of clear conditions. All individual pH measurements (annual median 8.0 units) were within the 6.0 - 9.0 units state standard. Surface temperatures ranged from 9.0 to 19.5°C and were normal for the time of the year. No temperature measurement in 2013 exceeded the state standard of 32.0°C. All individual dissolved oxygen concentrations (annual median 11.1 mg/L) were above the state minimum of 4.0 mg/L and were indicative of well-oxygenated waters. This site was monitored for the first time in 2013. Initial observations made during 2013 at this station were suggestive of good water quality.

Station ID: 47



Site: Tributary to Falling Creek at Krossridge Road

Latitude: 37.4570

Longitude: -77.6000

Watershed: James River

Land use: Residential

Number of Stations: 1

Volunteer Hours: 1.5

Number of Monitors: 1

Monitoring since: November 2013

This site is located on an unnamed tributary to Falling Creek in the north central area of Chesterfield. Stream measurements and water samples were obtained once per month for two months starting in November. Two surveys were conducted during 2013.

Table 1-29. Monthly values and annual medians for each water quality parameter measured during 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml
November	1	14.0	11.0	7.6	6.5	≥120.0	0.3	*
December	1	8.0	6.0	9.3	6.5	68.0	0.3	*
	Minimum	8.0	6.0	7.6	6.5	68.0	0.3	*
	Median	11.0	8.5	8.5	6.5	94.0	0.3	*
	Maximum	14.0	11.0	9.3	6.5	≥120.0	0.3	*

Surveys were conducted at this site for two months beginning in November 2013. One survey occurred on clear/sunny day. One occurred on an overcast/rainy day. Normal baseflow conditions were recorded on both surveys. Water coloration was described as light to dark brown during this two-month period. Trash was noted in November and leaves and debris were noted in December. No odors were noted in either survey.

Water depth was measured in each survey and was recorded as 0.25 meters each time. Transparency readings were recorded as 68.0 centimeters in in December and ≥120.0 centimeters in November. The median transparency value for this two-month period was 94.0 centimeters. Both pH measurements units were within the 6.0 - 9.0 units state standard. Surface temperatures ranged from 6.0 to 11°C and were normal for the time of the year. No temperature measurement in exceeded the state standard of 32.0°C. All dissolved oxygen concentrations (annual median 8.5 mg/L) were above the state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters. This site was monitored for the first time in 2013. Initial observations made during 2013 at this station were suggestive of good water quality.

Station ID: 200

Lake: Walton Lake

Surface Acreage: 26

Latitude: 37.4772

Longitude: 77.6325

Watershed: Falling Creek

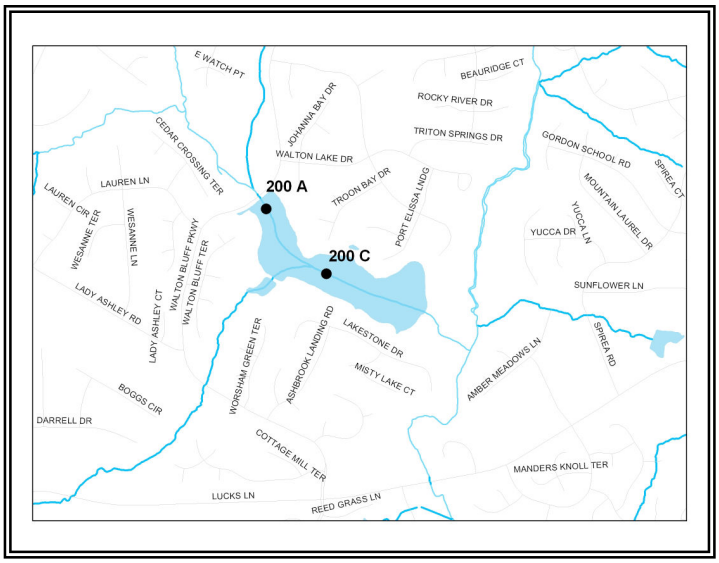
Land use: Residential

Number of Stations: 2

Number of Monitors: 1

Volunteer Hours: 18.0

Monitoring since: Spring 2004



Walton Lake is a manmade waterbody that was constructed and used as an amenity for the Isaac Walton League Hunt Club until the mid 1980s. The current dam was built in 1988 with the establishment of the Walton Lake subdivision. Homes surround the entire lake with the majority of the lakeside buffer as residential lawn. Residents utilize the lake for recreation such as boating and fishing. The lake's watershed is heavily developed with both residential and commercial properties. This year marked the eighth consecutive season of sampling since monitoring was temporarily suspended in 2005.

Table 1-30. Monthly and annual median values for each water quality parameter measured, 2013.

Date	n	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Secchi Depth (m)	Water Depth (m)	*E. Coli* (CFU/100ml
April	2	23.0	20.0	9.1	7.0	1.98	0.90	<20
May	2	26.0	28.0	8.8	7.3	1.91	0.86	<20
June	2	30.0	30.0	8.4	7.0	1.86	0.69	<20
July	2	32.0	30.0	8.4	7.0	1.84	0.69	<20
August	2	26.0	25.5	9.5	7.3	1.90	0.39	<20
September	2	21.5	22.0	9.2	6.8	1.84	0.71	<20
October	2	15.0	16.5	7.9	6.5	1.80	0.76	<20
	Minimum	15.0	16.5	7.9	6.5	1.80	0.39	<20
	Median	26.0	25.5	8.8	7.0	1.86	0.71	<20
	Maximum	32.0	30.0	9.5	7.3	1.98	0.90	<20
	2012 Annual Median	*27.5*	*25.0*	*9.3*	*7.0*	*0.64*	*1.90*	*<20*
	2011 Annual Median	*25.0*	*23.8*	*8.1*	*7.0*	*0.73*	*1.87*	*
	2010 Annual Median	*30.0*	*26.0*	*5.1*	*7.5*	*0.67*	*1.24*	*
	2009 Annual Median	*25.0*	*25.0*	*3.5*	*7.0*	*0.80*	*1.40*	*
	2008 Annual Median	*23.0*	*22.0*	*4.1*	*7.0*	*0.84*	*1.31*	*
	2007 Annual Median	*26.0*	*28.0*	*4.6*	*6.0*	*0.67*	*1.39*	*
	2006 Annual Median	*23.0*	*24.0*	*	*6.0*	*0.84*	*1.44*	*
	2005 Annual Median	*	*	*	*	*	*	*
	2004 Annual Median	*23.0*	*28.0*	*	*5.5*	*1.00*	*1.31*	*

Sampling at Walton Lake was conducted once per month at two sites from April through October totaling 14 surveys. Four surveys were conducted on sunny/clear days. Ten surveys were conducted on partly cloudy or overcast days. The water surface was described as having ripples present on all surveys. Water coloration was recorded as varying shades of light brown throughout the year. Earthy odors were recorded as varying shades of brown to green throughout the sampling season. There were no *Chara*

mats noted in 2013, a notable difference from years past. However, more *Hydrilla* was noted in 2013 than in previous years.

The annual median water depth for the monitoring stations on Walton Lake was 0.71 meters, a decrease from the 2012 median of 1.90 meters. Monthly median pH values during the year (annual median 7.0 units) for all sites were all within the 6.0 - 9.0 units state standard range and were similar to previously reported values. Monthly median surface temperatures ranged from 16.5 to 30.0^{o}C and varied normally with season. As in past years, all individual site temperature values were at or below the state standard of 32.0^{o}C during 2013. All dissolved oxygen concentrations (annual median 8.8 mg/L) were above state minimum standard of 4.0 mg/L and were indicative of well-oxygenated waters. Fourteen *E. coli* measurements were made at this site during the growing season. Samples were incubated for 48 hours at 24^{o}C. All *E. coli* tests measured <20 CFU/100ml and therefore did not violated the state bacterial standard 235 CFU/100ml for recreational contact in 2013.

Monthly Secchi disk depths ranged from 1.80 to 1.98 meters with an annual median of 1.86 meters. This was a large improvement over the 2012 median of 0.64 meters. The annual median Trophic State Index value of 65 was slightly lower than the 2012 median of 67 but continued to suggest that Walton Lake is a biologically productive and mildly eutrophic body of water. Trophic State Index Values of 74 in August were suggestive of mildly hypereutrophic conditions (index values > 70) during the summer. As mentioned in previous reports, further observation of Walton Lake with particular emphasis on the visual assessment of aquatic plant growth is warranted. All of the observations at this station continued to suggest good water quality within this biologically productive lake.

Discussion

Regular measurements of water quality were made by volunteers at thirty stream and river stations and at two lake stations in Chesterfield County. During 2013, there were 330 individual site visits conducted by 34 volunteer monitors, representing a total of 468.35 hours of effort. A summary of these measurements' annual median values is presented below in Table 1.

*Table 1. Annual median values of measurements made among all Chesterfield WaterTrends sites in 2013. *Denotes no sample taken **Denotes transparency measured in meters by Secchi disk.*

Station	Air Temperature (°C)	Surface Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Transparency (cm)	Water Depth (m)	*E. Coli* (CFU/100ml)
James River @ Robious Landing	20	14	8.2	7.5	107	*	*
Tributary to Falling Creek @ Rockwood Park	16.0	15.5	6.4	6.5	95.0	0.48	*
Tributary to Falling Creek @ Midlothian Mines	9	6	10	6.5	83	*	>20
Swift Creek @ Bailey Bridge Road	19	19	6.7	6.5	120	0.9	*
Nuttree Branch @ Brandermill	14	7	10.3	5.5	44	0.1	*
Spring Run @ Birdsong Lane	19.8	13	8.9	7	120	*	160
James River @ Enon	19.3	19.3	8.8	7.5	1.8**	0.5	160
Tributary to Powhite Creek @ Bon Air Elementary	17.8	13.5	8.8	6.5	120	*	80
Tributary to Powhite Creek @ Poplar Hollow Trail	20	15	8.5	6.5	120	0.14	60
Johnson Creek at Kingston Avenue	27.7	17.1	6.6	6	97	0.46	*
Second Branch @ Bundle Road	16	13	7.2	5	50.8	*	*
Tributary to the James River @ Old Gun Road	19	14	7.9	7	120	*	*
Winterpock Creek @ River Road	16	13.3	6.1	6	59.5	0	>20
Falling Creek @ Belmont Road	17.5	14.5	7.5	6.5	113.5	1.4	*
Falling Creek @ Kay Road	18.6	11.9	8.7	6.5	81.6	0.53	*
Horner's Run @ Fernbrook Park	15.5	15.5	8.6	6.5	75	*	*
Great Branch @ Chalkley Road	13.5	10.5	7.7	6.5	61	0.5	*
Marine Spring Branch @ Kings Farm Drive	21.5	16	9.4	6	120	0.1	>20
Oldtown Creek @ Branders Bridge Road	23	14.5	9.9	6	46	*	*
Otterdale Branch @ Lake Summer Place	19	15.8	6.8	6.5	73.05	*	*
Westbranch @ Prescotts Level	18	16	7.6	6.5	95.8	*	*
Second Branch @ Nash Road	19.5	15.5	10	6.5	71.3	1.15	*
Swift Creek @ Pochohontas State Park	18.5	12	8.6	6.5	96	2.8	*
Marine Spring Branch @ Knights Run Drive	21	15	8.1	7	120	0.17	*
Tributary to Michaux Creek @ Lastingham Drive	21	15.5	9.4	6.5	120	1	*
Spring Run at Mockingbird Lane	15.8	12.8	9.3	7	120	*	*
Tributary to Falling Creek @ Queensgate Road	21	19	6.7	6.5	80	*	60
Appomattox River @ Ettrick	13	12	9.6	8	120	*	*
Tributary to Falling Creek @ Krossridge Road	11	8.5	8.5	6.5	94	0.25	*
Walton Lake	26	25.5	8.8	7	1.84**	0.71	>20

As in past years, most annual medians of pH, dissolved oxygen and surface water temperature met Virginia Department of Environmental Quality (VA DEQ) surface water standards during 2013. Two site (5 and 13) annual medians for pH violated state standards. No sites' annual median for dissolved oxygen violated state standards.

pH

Observations of pH indicated that most measurements made during 2013 fell within the acceptable 6.0 to 9.0 units range specified by the VA DEQ. There were 13 reported violations of the state minimum standard for pH. No sites reported pH in excess of the maximum standard of 9.0 units in 2013. A summary of pH violations can be found in Table 2 below.

Table 2. Summary of pH measurements violating the VADEQ 6.0-9.0 unit standard range.

Station	Station Number	Monitoring Date	pH
Nuttree Branch in Brandermill	5	1/17/2013	5
		2/8/2013	5
		3/8/2013	5
		3/29/2013	4.5
Johnson Creek at Okuma Road	12	6/24/2013	5
		9/1/2013	5
Second Branch at Bundle Road	13	1/6/2013	5.5
		2/10/2013	5
		3/10/2013	5
		4/14/2013	5.5
		5/12/2013	5
		6/9/2013	5
Second Branch at Nash Road	34	1/13/2013	5.5
		2/12/2013	5.5
		3/29/2013	5.5

Site 5, Nuttree Branch in Brandermill, was monitored for the first three months of 2013. The pH measurements at this site violated the state standard of 6.0 to 9.0 units each time. There is insufficient data to characterize this site for the whole year, but its monitoring period pH median of 5.5 units is consistent with previous years. Nuttree branch is listed as impaired for pH by VA DEQ.

Site 12, Johnson Creek at Okuma Road, reported two violations of the state pH standard. These occurred in June and September. The remainder of pH measurements were within the acceptable range. Johnson Creek is currently listed as impaired for pH by VA DEQ.

Site 13, Second Branch at Bundle Road, was monitored for the first six months of 2013 and during each sampling it violated the state pH standard. The pH annual median of 5.0 units was the lowest of all sites in 2013. The entire length of Second Branch is listed as impaired for pH by VA DEQ.

Site 34, Second Branch at Nash Road, reported violations of the state standard for pH in January, February and March. The remainder of the surveys at this site reported pH measurements within the acceptable state range with an annual median of 6.5 units. As previously noted, Second Branch is currently listed as impaired by VA DEQ.

Dissolved Oxygen

Dissolved oxygen concentrations indicated adequate to well-oxygenated waters at most sites during 2013. There were five surveys at three stations that did not meet the state minimum standard of 4.0 mg/L of oxygen. A summary of violations of state dissolved oxygen standards can be found in Table 3 below.

Table 3. Individual instances of low dissolved oxygen (<4.0 mg/l) recorded among all monitoring stations during 2013.

Station	Station Number	Monitoring Date	Median Dissolved Oxygen (mg/L)
Winterpock Creek at River Road	15	11/08/13	1.3
		09/01/13	3.4
		09/27/13	3.5
Great Branch at Chalkley Road	25	09/15/13	3.9
Spring Run at Mockingbird Lane	39	08/11/13	3.4

At two sites (25 and 39), the observations of low dissolved oxygen were limited to one survey during the year. At Site 15 - Winterpock Creek, violations of the state standard for dissolved oxygen were noted three times. These observations were accompanied by elevated surface temperatures and reduced clarity. Winterpock Creek is listed as naturally impaired for dissolved oxygen by VA DEQ.

Temperature

Measurements of surface temperature at all sites varied normally according to season. There were no violations of the state standard of 32.0° Celsius in 2013.

Transparency

Water clarity was measured with a 120-centimeter turbidity tube (stream and river stations) or by a standard eight-inch Secchi disk at the James River near Enon Park and the Walton Lake stations. All readings and statistics discussed in this section are expressed as centimeters for comparison purposes. The greatest annual median transparencies of ≥120.0 centimeters were observed at ten sites during 2013. This reporting year was the third consecutive year that excellent water clarity was observed at the Tributary to Powhite Creek at Bon Air Elementary School and at the Marine Springs

Branch at Kings Farm Drive stations. Excellent water clarity was observed for the fifth consecutive year at the Swift Creek at the Bailey Bridge Road and Spring Run at Birdsong Lane reaches. The other stations where excellent clarity was present included the James River at Robious Landing Park, Marine Springs Branch at Knights Run Drive, Tributary to Michaux Creek at Lastingham Drive, Tributary to Powhite Creek at Poplar Hollow Drive, Tributary to the James River at Old Gun Road and the Appomattox River in Ettrick, VA. Substantially reduced clarity was observed at the Nuttree Branch site where the annual median transparency was calculated as 44 centimeters. This station demonstrated the lowest annual median transparency noted among all sites for the second year in a row.

E. coli

In 2013, *E. coli* monitoring using the Coliscan Easygel method was conducted at nine sites to characterize ambient bacteria levels. A total of 83 individual measurements at eight stream and river stations and one lake site were made throughout the year. Samples were incubated at varying temperatures and times ranging from 24 hours at 39^{o} C to 50 hours at 28^{o} C depending on site and were all within the method procedure limits.

The monitoring period medians observed at these nine stations ranged from <20 CFU/100ml at multiple reaches to 160 CFU/100ml at Spring Run (Station 6). There were eight individual measurements made at three sites that exceeded the 235 CFU/100ml VADEQ bacterial standard for recreational contact. Of these three sites, only one, the James River near Enon Park, was listed on VA DEQ's impaired waters list for bacterial impairment. The 2013 measurements at this station were consistent with previous data. Site 6 Spring Run at Bird Song Road, reported three violations of the state standard. These observations were made in July and August after periods of rainfall and when water temperatures were elevated. Site 15 Winterpock Creek at River Road reported one violation in July. A summary of *E coli* tests violating state standards is found in Table 4 below.

Table 4. E. coli densities observed at three sites in 2013 exceeding VADEQ recreational contact standard of 235 CFU/100ml.

Station	Station Number	Monitoring Date	*E. coli* (CFU/100ml)
Spring Run @ Birdsong Lane	**6**	**07/02/13**	**1020**
		08/06/13	**1600**
		08/25/13	**760**
James River @ Enon	**8**	**01/13/13**	**340**
		02/07/13	**320**
		03/10/13	**240**
		03/24/13	**740**
Winterpock Creek at River Road	**15**	**07/02/13**	**340**

General Observations

Volunteers made visual observations of water quality and wildlife during each survey. Most surveys were conducted on clear/sunny days (53%) or partly cloudy or overcast days (41%). The remainder occurred on days with showers or rain present (6%). Approximately 51% of visits were conducted during normal baseflow or calm conditions. There were 50 surveys (15%) that occurred during low flow conditions. High flows were noted 79 times accounting for 24% of the surveys. Flow conditions were not noted on the remainder of the surveys. A light to dark brown appearance was noted on 45% of the surveys. Clear water was reported on approximately 32% of the surveys. Turbid conditions were noted on approximately 8% of the surveys. The remainder of the surveys reported a variety of appearances. Milky conditions were noted fifteen times. Foam was reported three times. As in past years, no perceptible odors were recorded on most surveys (90%). The most frequently reported odor was earthy, at approximately nine percent. A fishy odor was reported one time. As in past reports, the most common trash item continued to be litter and leaves/debris in the fall and winter. Additionally, algae and pollen were frequently noted on the water surface or within the water column at several sites during 2013. A variety of wildlife was observed during the year to include aquatic insects, fish, frogs, turtles, songbirds and waterfowl.

Future Goals

The Chesterfield WaterTrends program will continue to grow with an emphasis on maintaining current sites, expanding monitoring coverage, improving communication with monitors and broadening the suite of testing parameters. The WaterTrends program will be supported with the aid of a 2014 VA DEQ Citizen Water Quality Monitoring Grant. The grant will support the purchase of equipment and the printing of the Chesterfield WaterTrends annual report.

In 2014, Chesterfield WaterTrends will continue to expand its bacterial monitoring and add macroinvertebrate monitoring using the Virginia Save Our Streams Rocky Bottom Method. The program will continue to add bacterial sites with an emphasis on areas with known impairments.

Chesterfield County WaterTrends Monitors

Much thanks and appreciation is given for the selfless volunteers who brave the elements to acquire data that assists in the protection of Chesterfield County's waters. Their stewardship is commendable.

Station 1	The Isman Family
Station 2	Elmer DeLa Cruz
Station 3	Jennifer Childress
Station 4	Joe Roussos, Cameron and Harrison Wells
Station 5	Theresa Biagioli
Station 6	Tom and Gretchen Cole
Station 8	Jim Turner
Station 10	C.E. Pond
Station 11	Joel and Margie Dexter
Station 12	Norah Fink
Station 13	Heather Turek
Station 14	The Schlosser Family
Station 15	The Cole Family
Station 18	John Vance
Station 19	J. Haviland and T. Jenkins
Station 21	K.D. Tuley
Station 25	Rich Marino
Station 26	Diane Lewis
Stations 28	The Kester Family
Stations 29 & 30	The Hagan Family
Station 33	Natalie Walker and Casey McGee
Station 34	Katy Turner
Station 35	Lisa Thompson and Susanna Kirschner
Station 36	Tyler Jutz
Station 37	Tyrone Murray
Station 39	Casey Allison
Station 41	Jennifer Childress
Station 46	Yolanda Robinson
Station 47	Lisa Thompson
Station 200	Dr. John Burmeister